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THE
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THE WAGES OF CENTRAL STATION WORKERS.

THOSE who have watched the course of the discussions of the last few years regarding the remuneration of central station employés have probably expected that sooner or later the matter would be brought to a head. Apart altogether from the question whether the Electrical Trades Union, the A.E.S.E., or any other organisation is the representative body, we may say that we have never supported niggardliness in the remuneration of this class of worker. The central station employé is worthy of his hire. In the past there has been want of organisation on the part of, and differences between, the men themselves, there has been no approach to uniformity of remuneration even for similar stations, and there has been in war-time little desire to treat the men as though they were performing a national service, which in a large number of cases they undoubtedly are. Our own pages have long contained abundant evidence that there has been continuous irritation and disappointment, and at times disaffection, because there appeared to be an unwillingness in certain directions to meet the men in the matter, and to adequately consider their claims. We have no desire to prejudge the case as it has developed under the changing conditions of war-time, conditions of which the Electrical Trades Union has not failed to take full advantage. Before the war broke out, that Union certainly did not represent the interests on behalf of which it now agitates. In those days, when the Union wanted to capture the central station men we attended a number of the meetings at which grievances were discussed. We do not hesitate to state that one of the things that then seemed to us to be throwing the employés right into the arms of the Union was the suspicion that the station chiefs and their authorities were disinclined to give a just hearing to complaints. The Union propaganda has been assisted by the A.E.S.E. policy of remaining inactive, on patriotic grounds, so as not to hamper the progress of the war. If there has been a disinclination to consider with reasonable generosity the war-time burdens of the men, it is easy to see that such dissatisfaction would materially assist the Electrical Trades Union in its propaganda, especially among what we may call the non-professional class of employés. Therefore, it is not surprising to learn from a report of the Hackney Municipal Electricity Committee that there "appears to be serious unrest prevailing throughout the electricity undertakings of Greater London at the present time." This unrest is "alleged to be mainly due to the delay on the part of various authorities in paying war wages awarded to the shipbuilding and engineering trades by the Committee on Production." Pressure is being brought to bear upon the Ministry of Labour with a view to securing a 48-hour week, increased normal pay to what is claimed to be paid in Government service, and the Committee on Production's awards in the engineering trades as war wages. As a result, the Associated Municipal Electrical Engineers (Greater London) have now decided to take steps to secure an agreement between the authorities and the Unions, and to introduce, as far as possible, uniformity throughout the London area. As stated elsewhere

in this issue, municipal authorities are now appointing delegates who will form a body to treat with the electrical and other Unions, and to secure the reference of the points to conciliation or arbitration if they fail to come to an agreement.

As we have said, it was, in our opinion, inevitable that something would have to be done sooner or later, and while we have no desire to prejudge the case, we cannot help regretting that it is only under pressure that there is now a prospect of matters being properly dealt with. We cannot regret that the whole subject has taken the present turn, whatever we may think of the past of the Electrical Trades Union, for it is a matter of which most of us have become weary. It is true that the new body now being appointed has relegated to it an investigation arising mainly out of war-time conditions, but it has a great opportunity of laying down a basis upon which the subject may be settled for some time ahead. Its task is not an easy one, even if limited to the war-time problem, but if it can so deal with that problem as to lay down principles regarding conditions and wages which may be applied at other times as well, it will have deserved well at the hands of everybody.

In war-time the nation has been trying to settle a hundred old controversies—sometimes it has succeeded. It is only right that we should, as far as possible, clear the way for the vast work of reconstruction that will occupy the serious thought of all of us for a long time to come. If the electrical industry can dispose of the irritating discussions and the fairly universal grievances that have attended employment of many classes engaged in central station operation it will have a clearer atmosphere in which to deal with the whole subject of national electricity supply. It will also have discharged an obligation towards station employés who are now away fighting, that legitimately rests upon it.

Protected Trades Certificates.

Sir Auckland Geddes, the new Minister of National Service, has lately delivered a speech in which he has shown a disposition to prefer older men behind the lines. The *Times* has very rightly suggested to him that this might be desirable if we contemplated remaining practically where we are, whereas it would be a handicap if "movement" became the order of the day. Sir Auckland states that he expects to receive new demands from the War Cabinet for younger men for the Army, and in that connection he would be well-advised to watch what is taking place in the indiscriminate granting to young men of certificates under the Protected Trades Schedule. We report some more cases of this character to-day in our "War Items." It may be perfectly wise to leave some young men in civil life at home—presumably as a general leavening influence, though our own information shows that things would run more smoothly without that "influence" in some districts—but the nation as a whole will not approve of a readiness to leave single young men in unimportant civil positions just because their employers are "on the Government list," while men of years, and with families and businesses, have to be taken for the Army. We should have supposed, especially at this stage of the war, that financial considerations alone would carry weight, the cost of a young single man of energy and good physique being trifling compared with that of a married man, who requires separation allowance, civil liabilities allowance, too, in many cases, with prospective heavy burdens for pensions, &c. But, as in some other things, perhaps we have got to the point where a million or two more or less doesn't matter!

Tramway Finance.

The Conference held by the Municipal Tramways Association at Blackpool, last week, was remarkably well attended, and proved highly successful; whether this was due to the attractiveness of the agenda or, at least in part, to the amenities of the place, is no doubt an open question, but, as we have remarked in another connection, there is no obvious necessity for all war-time conventions to be held in London, and we incline to the view that the choice of venue in this case was not without its effect on the attendance.

The *pièce de résistance* of the programme was the question how to make ends meet, a subject which is exercising the minds of a good many tramway managers in these extraordinary times, and in this connection the problem of securing an adequate income from passengers to cover the cost of their transportation, with a modest margin on the right side of the account, received the largest share of attention. Tramway undertakings labour under the burden of legislative restrictions even more irksome in some respects than those which hamper electricity supply, and in their case it is more difficult to obtain relief, as the Board of Trade has no power to authorise a variation in the statutory limit of fares; the direct intervention of Parliament is indispensable, and the attitude of that body on such a question is not likely to be sympathetic. So far as regards the ordinary passenger, a charge of one penny per mile does not appear to be unreasonable, and it seems to us that relief should be sought in other directions in which the injustice endured by the tramways under modern conditions is more readily demonstrable.

Prominent amongst these is the "workman's fare," the *bête noire* of many managers. The authors of the papers on tramway finance unanimously inveighed against the statutory requirement that workmen should be carried during certain hours at fares not exceeding a halfpenny per mile, and there is much to be said against the vicious practice of differentiating between different classes of the community, particularly when the concession bears so inequitably upon the public as in this case—for, as we have previously pointed out, it is a gross injustice that clerks, shop assistants, and other people who are often far less opulent than "workmen," should be deprived of the privilege enjoyed by the latter, simply because their working hours are not the same. A somewhat unexpected feature of the discussion, however, was the statement made by some of the speakers that owing to the density of the traffic, workmen's fares returned a profit in their districts. Presumably, therefore, it is rather the abuse than the use of the system that is to blame. The example quoted by Mr. Murray, and recently mentioned in our pages, of a journey of 19 miles for 2d. on the L.C.C. tramways can only be regarded as a monstrosity, but there are other instances of passengers travelling 10 miles for 2d., where 5d. would be the legal charge. The authorities who have sanctioned such fares, probably with political motives, have only themselves to blame if they result in a heavy annual loss, and the system cannot be justified on any ground. We strongly sympathise with Mr. Murray's suggestion that the tramway undertaking should be paid the full ordinary fare in respect of every passenger carried, without exception, and any concessions that the authorities desire to make should be paid for out of public funds, where their cost would be duly recorded and open to criticism. Under the existing conditions, the tramways are most unjustly taxed, not only in the interests of "workmen," a term which generally includes all classes who travel before 8 a.m., but also in respect of upkeep of the roadway which is used by their competitors, and in other ways.

SOME PRACTICAL EXPERIENCES WITH TOUGH RUBBER COMPOUND CABLES.

By W. ELLERD-STYLES, A.M.I.E.E.

Whenever a new commodity is introduced which tends to displace those already monopolising an industry, the inevitable result is a stalwart antagonism from the involved vested interests about to be displaced, irrespective of the virtues of the newcomer. The champions of an inferior commodity usually adopt an assumed name when attacking the new arrival, in order to conceal their identity. The introduction of tough rubber compound cables, hereafter alluded to as C.T.S., has been followed by the usual swarm of vindictive and defamatory letters to the various technical journals as a sequel to its growing popularity.

In reply to such, it is proposed in this article to quote the experience of several well-known contractors, together with details of some of the contracts carried out by each of them, appending their opinions in each instance in order to demonstrate that C.T.S. has been well tried and justifies its general adoption.

Contractors are now beginning to realise the advantages appertaining to the use of C.T.S. for lighting and heating installations, and it is with a view to giving information as to its suitability for power work that this article has been written.

The following are a few preliminary notes from the writer's experience of C.T.S. :—

The lay-out of a power installation is governed more or less by local conditions, but it is possible to adopt a somewhat uniform procedure in every situation; the only difficulty that has shown itself is the earthing of the apparatus. On one occasion a well-known contractor was called upon to install a motor in a position far removed from a suitable earth. It was, therefore, necessary to run the earth wire with the cables, and in doing so he made no attempt at concealment, with the result that the owner of the property made heated protests at seeing a bare copper wire run throughout the premises, as he presumed it to be a live wire. A simple remedy existed in threading the earth wire through the cleats at the back of the cable; a saw cut in the bottom of the groove is sufficient.

As to the kind of cable to be used for the heavy class of work, it is most suitable to use the circular section, twin or triple, as required, for the main runs, and single for connections between the motor and switchgear or control apparatus.

If it is necessary to run the C.T.S. cable underground, it can be laid without further protection, unless in a shallow trench, when warning bricks should be laid a few inches above it. For most situations the cable should be supported by cleats at frequent intervals to avoid sagging; for the lighter cables noncorrodible metal or ebonite saddles may be used. Where it is necessary to run the cable overhead, an auxiliary wire may be used to support the cable with the aid of suitable suspenders at frequent intervals.

Three reports have been selected for inclusion in this article from firms of high standing, and several useful hints are given which need no emphasis from the writer, as they are written by practical men.

Messrs. Bertram Thomas, electrical and mechanical engineers and contractors, Worsley Street, Hulme, Manchester, give the following report on C.T.S. wiring :—

"We would say that it gives us much pleasure to put forward jobs we have undertaken with C.T.S. cable. We instance four as follows, but would say that these jobs have practically been lighting jobs throughout. Of course, there has been a small amount of power work, but it has been very small considering the size of the jobs :—

"——— Sanatorium, for Manchester Corporation.—A hospital for soldiers. About 800 lights wired with approximately 10 miles of C.T.S. cable of various sizes.

"——— Mill, Failsworth, Manchester. — A cotton-spinning mill. About 350 lights wired with approximately 2½ miles of C.T.S. cable of various sizes.

"——— Mill, Failsworth, Manchester. — A cotton-spinning mill. About 200 lights wired with approximately 2 miles of C.T.S. cable of various sizes.

"——— Co., Ltd., Trafford Park, Manchester.—A lard refinery. About 500 lights and some motors wired with approximately 4 miles of C.T.S. cable.

"From our experience of C.T.S., we have certainly found it quite satisfactory on these jobs up to the present. The method of running the cables has been fixing of same with suitable metal saddles, and in each instance we have only used single cable.

"With reference to the ——— Co., we have run a considerable amount of the cable in the outbuildings there on cleats, and we find it very satisfactory from the *waterproof point of view*. The reason for using these cables in most instances has been that they are *waterproof*, and, as a consequence, we are getting little trouble from earthing or short circuits."

It is interesting to note that this report emphasises the waterproof qualities of C.T.S.

Messrs. Chas. Richardson & Sons, Romily, near Stockport, give an interesting description of power jobs, and they emphasise the great saving of labour over other wiring systems and the facility with which alterations and rearrangements can be carried out. Their report states :—

"We have pleasure in giving a rough outline of one or two of the installations we have carried out in C.T.S., viz. :—

"In a dye works, under particularly bad conditions, *V.I.R. cables both on cleats and in conduit had completely failed* on account of damp and acid fumes. We have wired some 200 lights and several motors of 1 to 6 H.P. in C.T.S. on 220 volts—the major part of it dating back some three or four years—and up to the present it has been a *complete success*. The *saving in labour* was found to be a very important consideration.

"In another case of a large felt works we recently cabled two motors of respectively 100 H.P. and 53 H.P. on a 400-volt three-phase supply, with three-core 600-megohm C.T.S., and it made *a very neat installation* saddled up with metal saddles. Here again was shown a considerable saving of labour when compared with other systems.

"In another instance we installed C.T.S. cables on a 250-volt D.C. installation in an asbestos process works. Some 250 lights, with a number of motors varying from 2 H.P. to 15 H.P. The saving of labour greatly influenced the use of C.T.S. in this work. We might mention another feature of this job, viz., that a considerable amount of alteration and re-arrangement has been done from time to time, and the open C.T.S. system has lent itself very well to work of this kind.

"Among other jobs we have used C.T.S. extensively in a leather works and tan yard for cabling to a large number of motors from 5 H.P. to 100 H.P., and it has given great satisfaction."

Messrs. P. Allman & Co., of 5, Queen Street, Manchester, have carried out many important installations with C.T.S. in situations of an extremely destructive nature, as shown in the following survey :—

"As you are aware, we have applied this under various conditions, and in almost every case without any other protection than its own sheathing, excepting where it might be subject to severe mechanical damage, in which case a short length of tube has been used, and, in our opinion, there are only three points to bear in mind, and if they have consideration, it is, without doubt, *the most perfect class of electrical cable* ever installed.

"No. 1.—Always use stranded cable.

"No. 2.—See that the cleats are of correct size for the diameter of the cable.

"No. 3.—Make sure that the ends of the cables are finished into the right type of fitting, and properly finished off.

"The following are details of a few of the contracts we have carried out in C.T.S. :—

"Ministry of Munitions : Steel Billet Breaking Plant.—1,400 B.H.P. In this instance, 50 per cent. of the wires were *installed in the ground*, and with no other protection than being surrounded by sand before filling in, and we have not had one fault on this job for 12 months.

"Messrs. Watson & Todd.—Underground main supplying

all light sheds, protected as above, installed *three years ago*, in perfect condition at present.

"Cresol-Picric Acid Works.—300 lights and 200 B.H.P. All cleat wiring on surface with switches outside of buildings. Carbolic, nitric, and sulphuric acid used in process, *without any detriment to the wiring.*

"Courtaulds Acid Plant.—300 lights and 180 B.H.P. All wiring on surface, protected from mechanical damage where necessary. Perfect test after nine months' running. Sulphuric manufactured at these works.

"We could, of course, go on with a longer list."

There is little doubt that the above experiences will be appreciated by those contractors who desire proof of the suitability of C.T.S. for hard service, and who require practical demonstrations before they venture to introduce new systems of wiring to their clients.

In conclusion, it is well to point out that the various classes of ironclad switchgear may be installed with C.T.S., using suitable brushes or nipples where the cables enter.

DIRECT-CURRENT BALANCERS.

By W. A. E. M.

It is well known that in approximating the maximum current rating of each machine composing a three-wire balancer set, we take rather more than half the maximum out-of-balance current to be passed through the middle wire.

In the case of balancer-booster combinations where the balancing unit is also required to act as prime mover to a pair of booster dynamos, such calculations are a little more complicated when something better than a rough approximation is desired. The following notes and formulæ may provide information of some use to many who handle inquiries and estimates for plant of this kind.

When the boosters of a balancer-booster set are to give an output calling for a motoring current exceeding the out-of-balance current in the middle wire, both machines forming the balancing unit will operate as motors and will take between them all the current called for by such conditions from the bus-bars, the motor connected across the heavily loaded side of the system taking half the difference between the middle wire and booster-motoring currents, and the other balancer machine taking half the sum of the mid-wire and booster-motoring currents.

When the out-of-balance amperes in the middle wire exceed the booster driving current, the balancer machine on the heavier loaded side will act as a generating unit giving a current rather less than half the difference between the out-of-balance and booster-motoring currents and the other balancer machine will work as a motor, taking rather more than half the sum of the out-of-balance amperes and the driving current called for by the boosters.

The two machines forming the balancing unit will, of course, as in the case of the plain balancer arrangement, be identical, each being liable to act in its maximum current capacity, according to the specified conditions of out-of-balance and booster loads.

Neglecting balancer efficiency we get for the current values—

$$C_n = (C_b + C_m)/2,$$
$$C_o = (C_b - C_m)/2, \text{ or } (C_m - C_b)/2.$$

These are actual values when C_b is greater than C_m, under which conditions both sides of the balancer are motoring, but when C_m is greater than C_b, the actual current values are—

$$C_n = (100\,C_m + C_b\,E)/(100 + E),$$
$$C_o = (C_m - C_b)\,E/(100 + E),$$

when—

C_n = amperes in balancer machine on normally loaded side of neutral wire;
C_o = amperes in balancer on overloaded side of neutral wire;
C_b = motoring amperes in balancer absorbed by booster load;
C_m = out-of-balance amperes in neutral wire; and
E = efficiency of balancer $(100\,C_o/C_n - C_b)$.

The value of C_b is, of course, $W_b/E_b\,E_m\,V_m \cdot 0001$, when—

W_b = watts output of boosters;
E_b = per cent. booster efficiency;
E_m = per cent. balancer motor efficiency; and
V_m = voltage across balancer motor;

and may be taken as approximately 5 to 6 amperes per kilowatt of booster output when the voltage either way of the middle wire is, say, 220; thus the motoring current in a balancer working across a 440-volt three-wire system will be for a booster load of 10 KW. about 50 to 60 amperes.

When the middle-wire and booster-motoring currents are respectively, say, 50 and 60 amperes, the currents in the balancer will be as shown in fig. 1, and, neglecting efficiency, the same current values exist with an out-of-balance of 60 amperes and a booster-motoring current of 50 amperes, the machine on the side carrying the out-of-balance load in this case acting as a dynamo, as shown in fig. 2.

Fig. 1.

Fig. 2.

When the balancer principle is employed in motor-generator or auto-converter voltage reducer sets, as shown in the diagram, fig. 3, in which system of connection the secondary current is the sum of the motor and generator amperes, the input current through the motor from the high-voltage side will be—

$$C_m = 100\,C_s\,V_d/V_p\,E_c \text{ or } 100\,C_s\,V_d/(100\,V_d + V_m\,E),$$

and the amperes given to the secondary circuit by the generator will be—

$$C_d = C_s\,(1 - 100\,V_d/V_p\,E_c), \text{ or } C_s\,V_m\,E/(100\,V_d + V_m\,E),$$

when—

C_m = amperes in motor;
C_d = amperes in dynamo;
V_m = volts across motor;
V_d = volts across dynamo;
V_p = primary supply voltage $(V_m + V_d)$;
C_s = secondary current $(C_m + C_d)$;
E = combined machine efficiency $(100\,C_d\,V_d/C_m\,V_m)$; and
E_c = conversion efficiency $(100\,C_s\,V_d/C_m\,V_p)$.

Neglecting efficiency, it will be seen that the current through the motor equals $C_s\,V_d/V_p$ and that the dynamo current is $C_s\,V_m/V_p$; thus, in the case of a motor-generator working off a 220-volt supply and giving out 50 amperes at 100 volts, the machine currents will be as shown in fig. 3.

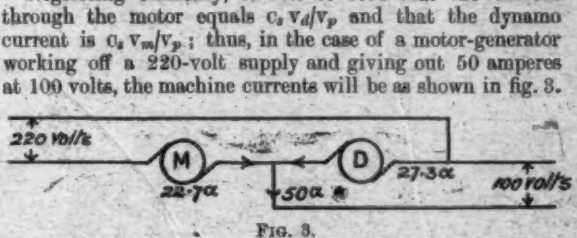


Fig. 3.

And if we assume a combined machine efficiency of 70 per cent., the motor current will be—

$$\frac{100 \times 50 \times 100}{(100 \times 100) + (120 \times 70)} \text{ equals } 27{\cdot}2 \text{ amperes,}$$

and the dynamo current will be—

$$\frac{50 \times 120 \times 70}{(100 \times 100) + (120 \times 70)} \text{ equals } 22{\cdot}8 \text{ amperes.}$$

It will be found that the actual commercial efficiency—*i.e.*, the efficiency of conversion—works out in the example taken as 83⅓ per cent.

The balancer system of connection of course offers an advantage only when the voltage reduction ratio is a low one (the advantage being that smaller machines may be used than with the ordinary arrangement of motor-generator having independent high and low voltage circuits) as, on the higher ratios of voltage, the conversion efficiency is low and the current supplied through the motor to the secondary circuit is too small to be of any value.

CURIOSITIES OF EARLY MAINS WORK.

By G. W. STUBBINGS.

MAINS work was not always carried out with the thoroughness that obtains at the present time. This was due not so much, perhaps, to a desire to cut down prices, or necessarily to careless workmanship, but rather, it would seem, to the lack of a general understanding of the reasons that make the various precautions required with paper-insulated and lead-covered cables necessary. As from time to time ancient specimens of cable work are unearthed in the course of renewals or fault repairs, the modern mains engineer gets some little amusement; but the pioneers should not, perhaps, be unduly criticised, for, after all, they were pioneers, and had not the accumulated experience of years to guide them.

Curiosities of early bonding are familiar to all; the prevailing ignorance of the principles underlying this precaution was really remarkable, and has only of late years been dispelled. The most noteworthy case of this kind in the writer's experience occurred at a straight-through box on a ·75 C.C. L.T. feeder. The bond was composed of a single strand of 18 S.W.G. copper wire, which had originally been stuck on to the lead of the cable by means of a drop of hard solder. On a fault occurring at another box on the feeder the bond-wire of the box referred to had burnt away, and the fault current burnt a large hole in the lead of the cable in the gland of the box. It is remarkable that this incipient fault never really developed, and it was discovered some four years afterwards during a systematic inspection of the boxes on the feeder in question.

The principle underlying the use of sealing chambers and pot ends does not seem to have been very thoroughly grasped by certain of the old school of jointers. The writer has in mind several examples of lamp services which terminate in a large lead pot end at the top of the post near the cut-outs. It was intended that the two cores of the twin cable should be sweated solid above the compound level, covered with a short length of rubber tube, and taken direct into the cut-outs, to save the jointing of rubber tails. In the particular cases which the writer has in mind, not only had the jointer neglected to sweat the cores solid, but he had allowed the paper insulation to protrude some $\frac{1}{4}$ in. above the level of the compound in the pot end. The most amusing case of this kind, however, occurred in connection with quite a modern job. An underground cable was laid by the supply company for the consumer to connect a subsidiary building with the main building at a certain factory. To supply a single light in a small shed situated between these two buildings, a tapping was taken off the main, the branch cable being a twin $\frac{7}{18}$ rubber, lead-covered and armoured. The job was inspected some weeks after completion, and it was found that the end of the V.I.R. cable in the shed had been adorned by the addition of a very large sealing chamber filled with compound. This must have been the gratuitous work of the wiring contractor. The finest feature of the job, however, was the fact that the end of the lead sheathing was a good $\frac{1}{2}$ in. above the compound level in the sealing chamber.

The necessity of a thorough system of cable records, like that of bonding, was not always recognised as well as at the present time. It is certainly a fact that many of the early mains foremen had a remarkable memory, and the early tendency was to rely unduly on this memory, very much as if it were a standard barometer or current balance that could be retained and preserved by the undertaking. A case occurred in the experience of the writer that shows that even an excellent memory is not infallible. In a certain road the east side was cabled throughout and the west side only partly. It became necessary to examine the service box for a house on the west side, past which the distributors were running. Considerable trouble was experienced in locating the service box, which was ultimately found on the east side of the street. It was thought that, as the east-side mains were known to have been laid before those on the west side, the service was connected before the latter mains were laid. A subsequent search through the old stores records revealed the fact that the service had been connected after the west-side mains had been laid, and the service cable had actually been laid over the west-side distributors, across the road to the east side. The only explanation of so remarkable a piece of work is that no record had been kept of the termination of the distributor on the west side, and that the person then in charge had, relying on his memory, thought that the west-side mains did not extend as far as the house in question. It may be added that subsequently a further similar example was found in the same road.

The fusing of distributors in disconnecting boxes is a matter requiring careful study and consideration in each particular case, and much trouble and inconvenience can be caused by the adoption of a careless and ill-thought-out system. The writer has come across more than one case of fuses, all of equal size, in the three branch distributors of a D.C. three-wire system in a T box supplying a dead end. Fortunately the fuses had never been called upon to operate.

Mention has been made of the circumstance that the defects of old mains works are not always due to a desire to reduce expenditure. This certainly applies to the early practice in a particular system for large consumers. Such practice was to lay two twin services with two service boxes, the result, of course, being that the neutral was double the cross section of the outers. It might be thought that two boxes were used because boxes for two branch cables were not manufactured by the firm supplying the cable accessories; but this was not the case, as boxes for two branch cables were in use for street lamps having both arc and incandescent lighting on the one column. It is difficult to see a reason for the costly proceeding mentioned; it may have been thought that two independent services would give a greater certainty of supply. The additional expenditure for large and long services was hardly justified. This idea calls to mind a system of distribution lately proposed, in which the live main is looped into each consumer's premises, in order that the distributor may, in case of need, be sectionised in each service cut-out box. Such a system sounds very inviting till the cost of a service—say 20 yards long—supplying a demand of 3 amperes off a ·2 distributor is considered. As in this case a ·2 — ·2 — ·012 three-core service cable would be required, the advantage of the system is rather expensive. The most futile example of supposed security occurred in the case of a 480-volt service supplying four circuits of 9-5-ampere arc lamps, fed two each way from a switch pillar. The service burnt out and the box was opened up. It was found that four $\frac{7}{18}$ lead-covered single cables had been run, two on each pole, and also that there were two fittings on each of the outer mains. As all the cables were taken into an unbonded piece of $1\frac{1}{2}$-in. barrel, the extent of the additional security can easily be estimated. The remarks of the jointer who removed the compound from the service box, and gradually discovered four fittings when he expected to find two, were not lacking in force and character, and, had they not been unsuitable in certain other particulars, they might have been recorded here.

A further curious piece of work occurred in connection with several circuits of street lamps originally intended to work two in series across 440 volts. There was one switch wire only, and each pair of lamps was connected to the switch wire and one outer main. The original idea of the 440-volt system was, presumably, to assist to preserve the balance. Some two years after these lamps had been connected it was decided that a 220-volt system would be more suitable—mainly, the writer believes, on account of the fact that with the original system the lamp and wiring in the bracket were always alive. The change-over was in one or two cases accomplished by altering the polarity of the switch wire from negative to neutral. The original objection, of course, remained, and the lamps were always alive, and the further curious circumstance arose that a fault on the switch wire would not, as a rule, blow the fuse, but would light the whole circuit of lamps.

The foregoing list of curiosities could, doubtless, be supplemented by scores of others that have been observed by various mains engineers. Indeed, it is singular how short a time ago the general ignorance of the principles of cable laying and maintenance began to be dispelled. It is only fairly recently that scientific methods of fault localisation became general, and there are still undertakings in which

such methods are not used, presumably because they are not understood. Such ignorance is, happily, fast dying out, and the average mains engineer of to-day is well equipped with the knowledge necessary for carrying out his duties with efficiency and thoroughness.

A FAULT IN ELECTRIC FURNACE CONTROL WIRING.

In the *Electrical World* of August 18th an account is given of an unsuitable system of control connections and of the method adopted for rectifying it. When the first of a recently-installed battery of Héroult steel furnaces was placed in service, great difficulties were experienced in its regulation, and the maintenance of a balanced current, either by hand or automatic regulation, was found almost

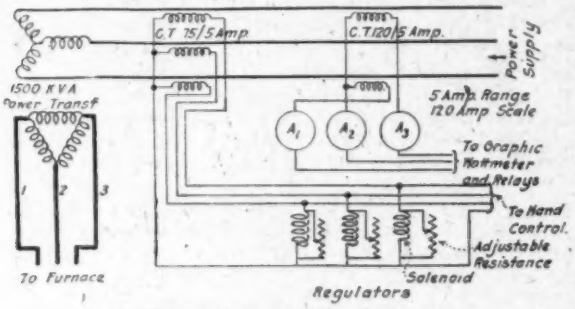


Fig. 1.—Wiring Before Change was Made.

impossible. A balanced reading being obtained on the ammeter, the condition was most unstable, and an increase of current in one line was as likely as not to be further increased by raising the corresponding electrode out of the bath.

The arrangement of the wiring was as shown in fig. 1. The ammeter readings were found to be proportional to the currents in the regulator coils, and the graphic wattmeter circuits were

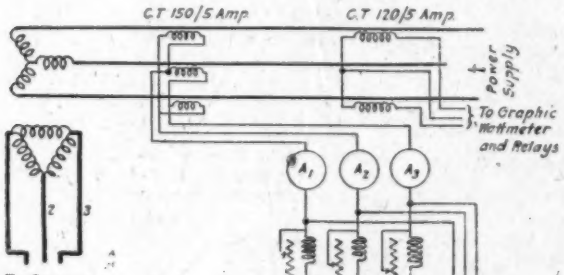


Fig. 2.—Wiring After Change was Made.

normal. The connections of the 1,500-K.V.A., three-phase transformer were found to be star-delta. With such an arrangement the currents in the ammeters and regulators will not of necessity be proportional to those in the electrodes, for the current in each electrode is the resultant of the currents in two secondary windings of the transformer, which are in turn proportional to those in two of the primary lines.

A reconnection of the power transformers was out of the question. Series transformers for the secondaries were suggested, but such transformers suitable for 10,000 amperes could not be purchased or made at short notice.

The problem had a simple solution: The three 75/5 current transformers on the regulator circuits were replaced by 120/5; the secondaries of these were connected in delta, thus duplicating the power wiring; the ammeters were placed in series with the regulators, and the wiring was left as in fig. 2. With these changes made, the furnace was found to operate normally, whether on hand or automatic regulation, and the arrangement was adopted for the other furnaces which were being installed, though it was found desirable to replace the 120/5 current transformers by 150/5 ratio, to get more suitable currents in the ammeter and regulator windings.

Coal Production.—Last year, 998,063 persons were employed in the coal mines of the United Kingdom, as compared with 953,642 in the previous year. The output of coal was 256,348,000 tons, as compared with 253,179,000 tons.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Prospects of the Central-Station Engineer.

It would be illuminating to prospective electrical engineers if you would open your columns to a discussion of the remuneration offered to, and the technical education expected of, a much-exploited profession.

Your article on "The Staff," I feel sure, ventilates the opinions of many excellent junior engineers who have been given the go-by for money and influence.

Staff Electrician.

[Our correspondent is, perhaps, not aware that this subject has on many occasions been discussed at length in our "Correspondence" columns. Its importance cannot be denied, but the obstacles in the way of reform are many and great. Under existing circumstances we cannot recommend young men of ability and ambition to join the staffs of power stations unless it be for the purpose of acquiring a first-hand knowledge of the organisation and working conditions of such stations, as part of their technical training, and not as a career. Of course, in war-time they have no choice in the matter.—Eds. Elec. Rev.]

A "European Concert."

Although I am afraid you will be unable to be present, I venture to send you an invitation and card of the first (pessimistic) anniversary dinner of the "Somewhere in France" electricity supply department.

We complete the 12 months' running this week, so thought it a reasonable excuse for forming a local branch of the Electro-Harmonic Society, for, in the words of George Robey, the restoration of "convivial nights."

I am not quite sure that the Censor will pass the "drawing" of the generating station, which may be considered of military importance to the enemy, for, as someone suggested, it might be identified from the cloud in the background.

It is getting quite an interesting little installation, consisting of slow-speed horizontal paraffin and high-speed vertical petrol sets,

NIL DESPERANDUM
ELECTRICAL & MECHANICAL
A 'Blow Out' to commemorate the many 'Bust Ups' we have experienced since Sept' 1916, when the Juice first made the lives of local 'Heroes' tolerable.
— September 11th 1917 —

at 2,000 volts, with aerial distribution. At present there are three stations turning out about 150,000 units per year, comparable, I suppose, with Exmouth, Falmouth, Sandown, Ventnor, and undertakings of that size. Of course, our working costs are hopeless, owing to the cost of fuel—portability, simplicity, and ease of erection being the principal factors. Still, we feel that we are keeping our hand in for "after the war" and the return to civil life—whenever that may come.

Ronald Grierson,
Captain (356 *E. and M. Co.*), *R.E., D.O.E.S.*
France, *September* 16*th*, 1917.

The City Guilds' Subject—"Electrical Installation Work."

This fundamentally important subject, which, until a year ago, suffered from the entirely inadequate name of electric wiremen's work, is once more under a cloud; and we wonder what the newly-appointed examiner, Mr. W. R. Rawlings, thinks of the matter.

In the new session's "Programme" of the City and Guilds of London Institute there is a prefatory red-ink notice to the effect

that the 1918 Exams. in the above subject will not be held if the war continues. A few non-electrical subjects are in the same boat, and there is a final threat that other Exams. may have to be suspended or modified.

Right up to the present time the fundamental electrical subject has suffered from neglect at the hands of principals of Institutes and heads of electrical engineering departments, who have consistently starved it, while spending money lavishly in other directions. In some Institutions the subject is considered an outside one, and its teacher a temporary member of the staff.

To make matters worse, the C. G. Examination authorities fenced the subject round with absurd barriers tending to discourage or render impossible attendance at the Exams. The various kinds of people who are concerned with electrical installation work cannot, by reason of their employment, always make the stipulated number of attendances; while no provision at all exists for private students to sit for examination. The introduction of this concession would have had surprising results in past years. Our own Exams. make us feel certain on this point.

The final blow, the threat of "no Exam.," is the more serious, as other classes will promptly be dropped. We say "other classes," because right at the beginning of the war some authorities straightway "put the lid on."

To discourage this particular Exam., at a time when recruits to the ranks of electrical workers are badly wanted, seems excessively feeble. It can hardly be a question of expense, for the latter must be very nearly proportional to the number of examinees.

We notice that the subject of gas fitting has not received a similar set-back. What have the I.E.E. and the E.C.A. to say to this?

Up to the session 1915-16 the prizes offered for "Electric Wiremen's (now Installation) Work," depended on the generosity of the Goldsmiths' Company. Now there are none at all. Should this discontinuance of prizes be permanent, so far as the Goldsmiths' Company is concerned, an excellent opportunity will be afforded the I.E.E., the B.E.A.M.A., or the E.C.A. of stepping into the breach.

The Society of British Gas Industries, the Institute of Builders, the Institute of Plumbers, &c., do their best to foster their respective industries in this way.

While the war is bringing home to millions of people the indispensability of electricity in various directions at the Front and in munitions works, it would almost seem that the authorities were bent on discouraging the study of fundamental electrical work otherwise "electrical installation work."

A. P. Lundberg & Sons.

London, N., *September 20th*, 1917.

The Fusing of an Electric Wire.

As wiring contractors, may we have the opportunity of supplementing your contributor's remarks after criticising the concluding paragraph.

Your contributor: "An electrical installation should be so good that after completion it can be left entirely to itself and almost forgotten."

I.E.E. Wiring Rules 1916, 130: "The value of systematically inspecting and testing apparatus and circuits cannot be too strongly urged. Records should be kept of all tests, so that any gradual deterioration of the system may be detected. Cleanliness of all parts of the apparatus and fittings is essential."

We think you will find that wiring contractors would like the latter rule to read as follows:—"Systematic inspection and tests *must* be carried out periodically by qualified electrical engineers."

Before an installation is connected up, the authorities and the insurance companies concerned will, perhaps, be most exacting; but afterwards the "budding" electrical engineer fuses up with door keys and wire nails. In large installations, before the contractor has completed his work, invariably one of his wiremen or a labourer is approached, and in due course installed as the firm's electrical engineer; a good man no doubt under supervision, but not fitted for the post.

Whilst the authorities assume their present attitude, this method is of more advantage to the customer until an accident or a fire occurs which calls in an Inspector. He is able to buy electrical material at a cheaper rate than the contractor can sell it to him, and, therefore, the customer receives the support and advice of travellers of some wholesale house, who, in turn, have had no experience of installation work.

This, we submit, is the root of the evil which brings the industry into disgrace, and a remedy should be adopted.

L. E. Wilson.

Manchester, *September 18th*, 1917.

The E.T.U. and the A.E.S.E.

I should feel obliged if you could find space for the following correspondence that has passed between Sir Geo. Askwith and myself in reference to the Association known as the A.E.S.E.

This Association, as the readers of your valuable paper well know, decided, at the outbreak of hostilities, to suspend operations during the period of the war. They, forsooth, were going to make no effort to benefit the men employed in central and sub-stations; as a consequence, the great bulk of their membership left them and joined the E.T.U. Now that our efforts are beginning to fructify, certain men want to resurrect this dead concern, and, of course, want to be represented before Sir Geo. Askwith. If they were so anxious for the welfare of this section of the industry, why did not they prepare working rules and conditions, and get into communication with Sir Geo. Askwith, &c.? Oh, no. But now that the spade work has been done, now that an effort is being made by the E.T.U. to improve, not only the status of these men, but also to improve them materially, the A.E.S.E. suddenly appears on the scene, and one can see the hand of the capitalist behind it all.

The E.T.U. recognises no other body as catering for these men. In London alone we have over 700 of them in our ranks to-day, with an ever-increasing membership, and we are not going to rest content until every central-station engineer, be he chief or switchboard attendant, is within our ranks.

W. J. Webb.

London, *September 24th*, 1917.

"*September 20th*, 1917.

"Dear Sir,—A large number of replies are being received from borough and supply companies, intimating that they are consulting their Committees or directors, &c.

"Can you give me any information as to the Association of Electrical Station Engineers, 26, Little Park Gardens, Enfield (W. J. Ebben, hon. general secretary), claiming to write on behalf of the executive staff of the central electrical and sub-stations—that is, the charge engineers—and requesting that facilities be given them to be represented at any conference?

"I am,

"Yours faithfully,

"(Signed) G. R. Askwith.

"W. J. Webb, Esq.,
"Electrical Trades Union."

"*September 21st*, 1917.

"Sir Geo. Askwith.

"Dear Sir,—Your letter of the 20th to hand; and in reply, my Committee would like the result of consultations as rapidly as possible. My Committee are aware that most of the Councils are in recess at the present moment, but the matter from our members' point of view is very urgent.

In respect to the Society you mention, my Committee do not recognise the Association as catering for the men concerned. They are not a Trade Union, and, until a fortnight ago, were dead, but evidently have been resurrected, either for the sake of kudos for certain individuals, or the benefit of the employers.

"Yours faithfully,

"(Signed) W. J. Webb,
"London District Secretary."

[In our opinion, no investigation made by Sir George Askwith can be complete without a hearing being given to the A.E.S.E. The suggestion that the "capitalist" has anything to do with the A.E.S.E. is grotesque; in suspending its campaign at the outbreak of war, the Association adopted the same patriotic policy as the E.T.U., which, with equal loyalty, abandoned the fight with the wiring contractors which was then in progress, and to misrepresent its motives at this time is unfair and in bad taste.—Eds. Elec. Rev.]

A Static Electricity Phenomenon.

The correspondence on this subject reminds me of a similar experience I had some years ago, when long sparks were drawn from a steam leak at a joint on a Lancashire boiler stop-valve.

The phenomenon is explained in the text-books of electricity and magnetism.

By friction the particles of condensed water in the jet become charged, and, as Sir W. Armstrong found in his investigation with his hydro-electrical machine, he could produce sparks 5 ft. long.

Wm. Frisby.

Electricity Supply Department, Colchester,
September 24th, 1917.

Magnets and Magnetos.

Will any reader kindly answer the following inquiries?:—

1. Permanent magnets: Where to obtain best steel for same, average value of $B_{residual}$ and max. value of B (sq. in.) when under process of magnetisation.

Also given B (sq. in.) = 1,000 for a certain steel, what will be value of flux in a path of reluctance z?

2. Publisher's name of a book on magnetos dealing fully with theory from a scientific standpoint, and giving all types, past and present.

3. Details of most instructive works dealing with wireless telegraphy and telephony.

B. E. F.

Electrical Rain-Making in Australia.—In the course of his tour of the east-west railway the Minister of Works and Railways, Mr. Watt, inspected the rain-making device set up by Mr. J. G. Balsillie, late Commonwealth wireless expert, at Bookaloo, and, upon the evidence placed before him, decided that the experiments should be continued. Comparisons made and data collected over some 15 or 16 years indicated that Mr. Balsillie's scheme had induced an increased rainfall of between 50 and 70 per cent. in the Bookaloo area, about 50 miles west of Port Augusta. The Bookaloo apparatus had been shifted to Wynbring for further trials, which would be continued for a considerable period. The Government proposed to obtain two more plants from Mr. Balsillie, and, after consultation with the Government Meteorologist, use one in New South Wales, and, possibly, one in Victoria, in grazing and wheat growing areas respectively. The cost of each plant, with a full year's upkeep, was about £800.—*Melbourne Age.*

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Stansiphon.

During the Christmas meetings of the American Association for the Advancement of Science a self-starting siphon was shown, the trade name for which is the Stansiphon.

The self-starting device is shown in fig. 1, and consists of a bulb (4) sealed into the lower end of the tube (2) and an inner tube (5) sealed into the base of the bulb and reaching into the opening of the bulb at the top. Here the end is somewhat constricted, and its size and position with respect to the top of the bulb are so adjusted that an "air trap" is produced at (6). A small opening (7) is made at the lower part of the bulb.

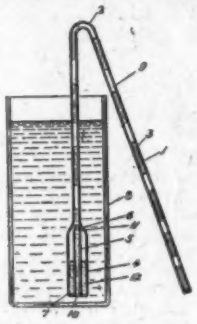


Fig. 1.—A Self-Starting Siphon.

If the bulb be inserted to a considerable depth into the liquid to be siphoned, the liquid flows into the bulb through (7) and displaces the air, which with the water passing through the inner tube (5) rises in a broken column in tube (2) and flows out through the delivery tube (1).

To operate successfully on ordinary liquids the Stansiphon should be immersed to a depth at least two or three times the length of the bulb.

A design has been made which successfully siphons acids from carboys, but owing to the heavy density of these acids it works relatively slowly as compared with water. Light oils such as kerosene and gasolene are readily siphoned by this method, but as yet a suitable design depending on this principle has not been found for the heavier oils.

The wide application of the Stansiphon is apparent especially in chemical laboratories, drug stores, manufacturing and other establishments where liquids and various solutions are in constant use. In transferring corrosive poisons or valuable liquids it obviates liability to accident or waste. It should also have a wide application in the filling and emptying of all sizes of storage-battery jars. When a solution is to be kept "on tap" for instant use, a stopcock may be provided. These siphons in addition to glass are being made of brass, copper, zinc, lead, iron, hard rubber, &c.

Application for patent rights has been made in the name of the inventor, Gustavus A. Storm, but all rights, title and interest in the same have been assigned to the Standard Scientific Co. of New York.—P. B. Perkins, in *Science*.

The "Autofrigor" Small Refrigerating Machine.

Hitherto, the equipment available for producing cold—or rather, extracting heat—on a small scale by mechanical means has involved a good deal of skilled supervision and attendance in respect of belt drives, valves, manometers, and stuffing boxes, &c. A set designed to eliminate the necessity for any skilled attention, and hence to be suitable for use in private houses, has been placed on the market by the Elektrofrigor Gesell. (Berlin), and is described in a recent issue of *E.T.Z.* The working parts are extremely simple, and are assembled in the form of a vertical cylindrical unit. On top there is a squirrel-cage, three-phase, induction motor with vertical spindle and ventilated stator housing. This machine is mounted on, and coupled directly to, a compressor, the cylindrical casing of which is mounted on top and at one end of the refrigerator chamber. The latter is in the form of a rectangular chest, and access to it is obtained by a lid in the remainder of the top. Below the compressor, and entirely within the refrigerator chest, is the vaporising chamber, which is cylindrical in form but of corrugated metal, in order to give maximum cooling surface. The condenser is placed round the compressor housing, and is itself surrounded by a water jacket, through which water is circulated continuously.

Methyl chloride is used as the cooling medium. Vapour is drawn from the vaporising chamber by the compressor, and forced into the condenser. Thence, the now liquid refrigerant passes into the vaporising chamber through a reducing nozzle, and by its evaporation and expansion extracts heat from the surroundings. The expanded vapour is again drawn into the compressor and the cycle repeated. The whole vapour circuit is said to be sealed hermetically, so that the cooling medium needs no replenishing. The cold box can, of course, be used for cold storage or for ice making. No particulars are available as to the power of the motor used, or the heat-extracting capabilities of the machine beyond the statement that "a temperature of −5° is reached after a few hours' working." The only manipulation required is to open the cooling-water valve and close the motor switch when it is desired to start the machine. The advantage of the squirrel-cage motor in point of simplicity and absence of brush gear is obvious, but one fails to see the point of the recommendation (made by *E.T.Z.*) that a converter be installed to secure this advantage in the refrigerator motor, if three-phase supply be not already available.

A Highly Sensitive Electrometer.

Mr. A. L. Parson, Chemical Laboratory, University of California, has devised an instrument in which the principle of working in a condition approaching instability is used to increase greatly the sensitiveness of the quadrant electrometer. The box-shaped quadrants are replaced by flat sectors subtending about 70° each at the centre and arranged as shown in fig. 2. Because of the two large gaps between A and B′, and between A′ and B, the needle hangs stably, as shown by the dotted lines, by virtue of electric forces quite apart from the torsion of the suspension. (Incidentally, this makes it possible to use a torsionless suspension or a float for the needle, which latter has been tried with some success.) If now a potential difference is set up between A A′ and B B′ the needle is deflected, at first nearly proportionately to the potential difference, and then less and less as the large gaps are approached.

The approach to instability, and hence an increase in sensitiveness, is brought about by means of a mechanical device, which on turning a micrometer screw can be made to widen the small gaps between A and B and between A′ and B′, thus making the needle

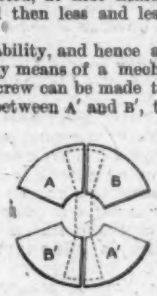


Fig. 2.—Quadrants and Needle of Sensitive Electrometer.

less and less stable in its central symmetrical position. In this way the sensitivity, which in the least sensitive condition is about 3 mm. per millivolt at a scale distance of 5 metres, can be raised to as much as 60 mm. per millivolt easily, and with some care even to 150 mm. per millivolt.

A most important feature of the instrument is that, on account of the relative unimportance of the thickness of the quartz suspension, the sensitivity to potential differences is practically independent of the size of the instrument. The last model made, with a needle 1·8 cm. long, has a capacity of 9 cm., but this could without difficulty be halved by reducing the size of the instrument; and it might be halved again by omitting one end of the needle and the pair of sectors below it.

Although the sensitivity of the electrometer (with the very efficient optical system used) is theoretically great enough to detect 10^{-9} volt, it has not as yet been made steady enough to detect an isolated potential difference of less than about 3×10^{-6} volt. The device was described in a paper presented to the National Academy of Sciences.—*Scientific American Supt.*

A New British Magneto.

The British Lighting and Ignition Co., Ltd., of Tottenham Court Road, London, W.C., have lately brought out a new type of ignition magneto, the B.L.I.C., H.L.8 type, specially designed for 8-cylinder engines. Instead of being of the usual rotary armature pattern, the armature has a stationary winding, and an iron sleeve, the latter revolving between the armature core and the pole shoes. Among the advantages claimed for the new machine are that it gives four sparks per revolution as compared with only two in machines with rotating armatures, and that the windings, being stationary, are not submitted to any centrifugal strains.

New Accumulator Plate Separator.

A new accumulator plate separator, which is claimed to be a great advance on wooden separators, has lately been adopted in the batteries made by the Willard Storage Battery Co., of Cleveland, O., U.S.A. The new separator is stated to consist of a rubber composition containing a very large number of threads, which act as wicks. The threads are about $\frac{1}{16}$ in. long, and when wetted by the acid offer, it is claimed, little resistance to the passage of current.

Emergency Storage of Coal.—In the *Electrical World* of August 18th, a simple and inexpensive method of unloading coal on open ground is described. The railway wagons, with hopper bottoms, are run on to a track, and the coal is deposited on the track and between the sleepers by opening the doors. The coal is pushed off the rails when the wagon is withdrawn by a balk of timber inserted in front of the rear wheels. When the whole length of track has thus been covered with coal, the track is jacked up and rests on the coal, and the process is repeated until the pile is 10 or 15 ft. high, when the track is relaid on the ground and a second pile is begun. To remove the coal, the track is laid on the ground alongside of the pile, and the coal is loaded into wagons by a locomotive crane.

THE MUNICIPAL TRAMWAYS ASSOCIATION (INCORPORATED).—II.

The decision of the Executive Council to hold the 16th annual conference of the Municipal Tramways Association (Incorporated) at Blackpool, on Thursday and Friday of last week, was justified by an excellent attendance. Nearly 160 delegates, principally tramway managers, and chairmen and vice-chairmen of tramway committees, were present from all parts of the Kingdom. In addition, there were present as guests, amongst others, Mr. H. E. Blain, of the London General Omnibus Co., Ltd., and Mr. W. G. T. Goodman, general manager of the Adelaide Municipal Tramway Trust, and President of the Tramways Association of Australia.

Mr. Henry Mozley (general manager, Burnley Corporation Tramways), the President, was in the chair, and he was supported by Ald. S. Flint, J.P. (Leicester), the Vice-President, past presidents in Mr. P. Fisher (Dundee), Ald. H. Linsley, J.P. (Salford), and Mr. A. B. Fearnley (Sheffield), the hon. treasurer and secretary *pro tem.*, and by Sir J. W. Courtis, J.P. (Cardiff), and Ald. C. F. Spencer (Halifax), Members of the Council.

The Mayor of Blackpool, Coun. A. L. Parkinson, J.P., extended a civic welcome to the conference, and remarked that the time had arrived when the tramway committees of the country would have to take into consideration the question of obtaining powers for the revision of fares. The railway companies and gas and electrical undertakings had had that power, and it was necessary in their case, when he found that 16 tramway systems in the country were not able to turn the corner financially, and when 20 systems only made a profit equal to no more than 6d. per 100 passengers. In Blackpool they had a good surplus profit, due to the large number of visitors, but their position was exceptional. One route, Marton, which they opened out some years ago, resulted in a big loss for several years, but the development of property and the increased rateable value had repaid the town many times over.

Thanks to the Mayor were heartily given, after which Mr. Mozley gave the presidential address, reported in our last issue.

Tramway Finance.

Mr. G. W. Holford (Salford) read a synopsis of the paper on "Notes on Tramway Finance," of which we gave an abstract last week.

Ald. C. F. Spencer (Halifax), who opened the discussion in a lengthy speech, said the paper was of a more provocative character than usual, and he welcomed it on that account. He thought the question might be summed up under eight heads: (1) The question of national finance and its effect on municipal finance, (2) the rising cost of wages, (3) the increase in the cost of materials, (4) the increase in fare revenue, (5) the reduction of electrical power consumption, (6) the costliness of Parliamentary procedure, (7) the weakness and strength of municipal administration, and (8) a new adoptive policy. The question of finance was an exceedingly complex one to-day. Before the war, local authorities in Lancashire and Yorkshire were able to borrow at about 3½ per cent. Now, owing to the great cost of the war and other causes, the money rate had advanced, and as, after the war, the demands were likely to be very heavy, the rate of interest would mount still higher. They did not want the local authorities to be competing with the Government afterwards, thus forcing up the rate, and he thought the municipal authorities ought to go as a united body to the Chancellor of the Exchequer, and suggest that it would be far better if the Government borrowed for the whole lot, and then lent the money to the local authorities at a uniform rate. He was sorry to see the reference to the suspension of sinking funds. The suggestion was made in a Manchester paper some time ago, and within 10 days he received 500 letters in reference to the matter. The popular idea of suspension was repudiation, and it would be better if they asked Parliament to remove restrictions, and to enable tramway authorities to raise the fares. He did not believe in local authorities saddling their undertakings with the heavy incubus of rate relief, and he thought that not more than 1 per cent. on its capitalisation should be paid by the undertaking to the local authority. Wages had got to the breaking-point, and he thought there ought to be a uniform adjustment on this question, whilst their workmen ought not to be treated as if they were automatic machines. Regarding fares, they were hide-bound by Parliamentary precedent, and he was inclined to say, with Lord Milner, "Abolish precedents and damn the consequences." Everything had gone up in price except rain, fresh air, and tramway fares. Ald. Spencer advocated the establishment of power stations near the sources of coal and water supplies, the current to be distributed to the local authorities, and condemned the present method of generation as most wasteful. He also urged that the tramways committee should have such statutory powers that its decisions could not be upset by the mere caprice of the Council as a whole. They should have a more commercial administration, and a greater continuity of policy.

Mr. Arthur Ellis (engineer and manager, Cardiff Corporation Tramways) said that many municipalities, including his own, were inclined to regard the Board of Trade Departmental Committee on Electricity Supply with great suspicion. Local authorities ought to have more representation upon it. He was the chairman of the Linking-up Committee for South Wales and Monmouthshire District, and they, like Lancashire and Cheshire, were going to try and show that the Board of Trade Committee was not likely to be required in settling this question. As to increased fares, he believed that the working classes, who did not know how to spend their surplus wealth, would pay them willingly. He condemned the present method of settling disputes through the Committee on Production, as it seemed that the employés had only to threaten the Committee to get what they wanted. They had every desire to be fair to the employés, but they did not like their hands being forced. At Cardiff they carried their own insurance, with the result that after paying one-half of the premiums which a company would require they had saved £20,000 in 14 years, and had a good reserve.

Ald. R. T. Fletcher (chairman, Wigan Tramways Committee), referring to the rise in interest, asked why they should pay interest at all on borrowed money. He suggested that municipalities could issue notes, to be repaid at a certain period, but bearing no interest, and there need be no repudiation of the sinking fund.

Bailie M. W. Montgomery (chairman, Glasgow Corporation Tramways) said that their experience had been that as they had reduced the fares or increased the stages the traffic had gone up by leaps and bounds. Their halfpenny fares were very profitable, but their conditions might not apply to other localities. If all fare restrictions were removed, private companies would have monopolies that would be prejudicial to the public interest.

Mr. R. J. Bishop (vice-chairman, Walthamstow District Council Tramways Committee) said his Council sat from 7 p.m. to 5 a.m. next morning before it decided to abolish halfpenny fares, but the step had proved a thorough success, and had been the means of turning a deficit into a profit. It set an example which had been followed throughout the London area.

Mr. W. Murray (general manager, Walthamstow) said that their experience of car meters to check the consumption of electrical current had been very successful, and had been the means of saving thousands of pounds.

Coun. Dan Irving (vice-chairman, Burnley Corporation Tramways) said that anyone who had listened to the discussion would be justified in assuming that they were an association of privately-owned tramway companies, the sole object of their existence being the making of profits for shareholders. The principle of municipal ownership was public utility, without thought of profit. Public utility was altogether superior to profit, or ought to be so, and he thought the time would come when tramways would be free to all who required to use them, just as roads and bridges, over which a toll had once to be paid, were now free to the public.

Mr. W. G. T. Goodman, at the request of the President, gave an interesting statement on tramway matters in South Australia. There, he said, they had not adopted workmen's fares, but they had special fares for children, and they found that it brought traffic from other sources. On the question of power consumption, it would be impracticable to adopt car meters as, owing to labour conditions, they often had to change their car crews seven times a day. They had a properly constituted authority to settle matters in dispute between employers and employed, and the system worked very well, as it relieved the management of a great deal of responsibility. If, however, there was an authority to fix wages, there ought also to be one to fix fares in accordance with the increased expenses.

Coun. Fryer (Birmingham) said there was danger in the suggestion that a tramways committee should be regarded as separate and distinct from other municipal undertakings. It was an integral part of the municipal organisation, and he disliked the term "trading departments" when they performed a great public service. If a tramway undertaking, maintained on a sound and stable financial basis, with its management properly remunerated, and its employés working under decent conditions, made profits, then it was assuredly worth while to deflect some of those profits to helping on the prosperity of the town.

The President defended workmen's fare traffic, which he considered to be very profitable, and said that at Burnley they found no difficulty in differentiating between those who were entitled to reduced fares and those who were not. Parcels traffic was highly profitable—75 per cent. of the receipts were profits—if it was properly managed.

Mr. Holford, in replying to the discussion, said the question of finance was one over which the tramway committees had little control. The local authorities were seeking increased representation on the Board of Trade Committee on Electricity Supply. He did not think they were out to make profits, but they wished to avoid losses, and if profits were made on tramways he did not care how they were applied, so long as the systems were maintained in a sound financial condition. He thought it would be a long time before tramways became free, and, personally, he would not like to have

to manage such a system. He thought free food and free water ought to precede free travelling.

The Rule of the Footpath.

Mr. J. Dalrymple (general manager, Glasgow Corporation Tramways), who should have opened a discussion on "The Rule of the Footpath," was unable to be present owing to the Royal visit to the Clyde, and his notes on the subject were read by Bailie Montgomery. The point raised was as to whether or not it was time that the rule of the road regarding pedestrians to "keep to the right" should be altered so as to be the same as for vehicular traffic, "keep to the left." From a tramway point of view, it was an important question, as uniformity would tend to prevent confusion, and so avoid accidents. Of 87 tramway authorities circularised, however, 39 had not given the matter consideration, 15 had come to no decision, and a like number had expressed approval. In one case the change had been made, and only three had put forward objections.

Coun. T. Canby (vice-chairman, Huddersfield Tramways) said his Council had discussed the matter, but felt that it was more of a national than a local one. If adopted, however, it would be of great benefit.

Mr. H. E. Blain (London General Omnibus Co.) said this was a matter of much greater importance to traction people than they might imagine. In the Metropolitan area they had 46,000 street accidents in a year, of which 800 were fatal. When he joined his company the accident record and the amount paid in claims were phenomenal, but at the end of four years they had reduced their claims costs by £50,000 per year. In analysing the claims, it was found that if the rule of the footpath had been reversed three-fourths of the fatal accidents could have been avoided. In the London district 38 authorities were in favour of the change, and only eight against. Mr. Blain also referred to the success of the "safety first" campaign.

Sir J. W. Courtis (chairman, Cardiff Corporation Tramways) suggested that the Home Office should be approached by a deputation on the matter, and this was supported by Mr. A. H. Scott, J.P., L.C.C., and Ald. Spencer, Halifax. Other speakers, however, pointed out that the present rules of the road were largely ignored both by pedestrians and by drivers of vehicles.

It was decided that the Home Office and the various local authorities should be communicated with on the subject.

Differentiation in Fares.

Mr. W. Murray (general manager, Walthamstow) then presented his paper on "Differentiation in Fares," which was reported last week.

Coun. J. Moon (deputy-chairman, Plymouth Corporation Tramways Committee), who opened the discussion, said he thought the present concessions were largely the result of weak-kneed management in the past. If concessions had to be made to workmen, blind people, &c., by tramway committees, then other committees should do the same. Tramways were business undertakings, and not philanthropic undertakings.

Ald. Broadley (Halifax) contended that workmen's cars paid, and said that if they could have the same loads throughout the day they could afford to run at workmen's fares.

Mr. W. J. McCombe (tramway manager, Hull) said they carried the workman there two miles and seven-eighths for a halfpenny, and the traffic was a profitable one, but this was a question which every municipality must decide for itself, having regard to its own conditions.

Mr. Wm. Clough (general manager, Bury Corporation Tramways) pointed out that Mr. Murray, in instancing the success of a halfpenny fare over the High Level Bridge at Newcastle, did not mention that this was a case where it was as cheap to ride as to walk, as, though the distance was only a quarter of a mile, every foot passenger had to pay a halfpenny toll.

Mr. A. Ellis (Cardiff) said that owing to the whole of their industries centring at the docks, workmen's cars, at four and four and a half miles for a penny, were a distinct loss, as the cars had to run back empty, whilst in the evening, at the busiest time, they had to put aside 33 cars for the purpose of taking the men home again, with the result that often people who would have paid 2½d. for the journey had to walk.

Mr. R. J. Bishop (vice-chairman, Walthamstow) said their cars were running practically empty from 10 a.m. to 5 p.m., and he did not think that Mr. Murray should have saddled the whole cost upon the workmen's cars. The probability was that if the workmen's cars were taken alone it would be found that they paid.

Mr. P. Fisher (general manager, Dundee) spoke of the great success of cheap fares there, where the maximum was one penny, but Mr. W. J. Squires (vice-chairman, L.C.C.) said he did not think the halfpenny fare would come back in London.

Mr. Murray, in reply, said he was satisfied that workmen's fares were not of much use, and that since they had abolished halfpenny fares and increased workmen's fares by 50 per cent. their traffic receipts had risen fully 4d. per mile.

Mr. Arthur Ellis (Cardiff) read a paper on "The Development of Tramways," but the discussion was adjourned until the following day.

The Development of Tramways.

In opening the discussion on Friday morning, Coun. C. Raine, J.P. (vice-chairman, Hull Tramways Committee), said that although Mr. Ellis had entered upon the somewhat dangerous sphere of prophecy, he was perfectly justified, for they all recognised that great changes would be made in the future in every phase of life, and probably in none more than tramway traction. The possibilities of development of passenger and goods traffic seemed to be overwhelming. The great difficulty was in joining up the urban and the suburban districts for the benefit of both. A point to which attention might be given was the provision of transit facilities for the people who lived in congested areas off the main thoroughfares of our cities, and who were entitled to have such facilities equally with those who lived on the principal roads. He thought that railless trolley cars might be used here with advantage. The present system, by which they had to go to Parliament when they wished to extend their systems, should be relaxed.

Mr. A. R. Fearnley (general manager, Sheffield) suggested that Mr. Ellis held the motor 'bus, as a factor in development of traffic, much too lightly. For the past four and a half years Sheffield had been largely developing rural traffic by motor 'buses, with most satisfactory results, for they had built up a traffic carrying 6,000,000 passengers per annum, with receipts amounting to £40,000. He suggested that there was a great deal to be done in developing the riding habit, seeing that out of a number of towns of which he had details there were only eight in which there was an average of over 200 rides per head of population per annum, whilst there were 58 between 100 and 200, and 37 below 100. Through-running and linking-up of systems were great features in the development of the riding habit.

Mr. N. J. Young (general manager, Newport Tramways) said the time was ripe for the consideration of housing, town-planning, and tramway development as part of one combined scheme, and he thought there ought to be some measure of national assistance in the matter. Why should not Great Britain be divided into representative districts, worked under Government control, and grants be made to assist tramways extension where necessary?

Ald. W. C. Fenton (vice-chairman, Sheffield) objected to the idea, as tramways were a local, not a national, question, and Government control might mean interference with local authorities as to where extensions should take place. He believed in the American idea, that the provision of tramways made for population, and he advocated a bold policy in this matter.

Mr. A. Baker (general manager, Birmingham) said the present method of Parliamentary control over the schemes of local authorities regarding tramways was simply monstrous. If a Council wished to extend its system in its own area it should have the power to do so, and though some form of control might be necessary where the interests of two or more authorities were concerned, some less costly procedure than the present one ought to be possible.

Ald. Spencer (Halifax) referred to the question of goods traffic by tramcars as being one of vital importance, both from a departmental and from a national point of view. He instanced the case of a company with which he was connected, and which had made arrangements with the Leeds Corporation Tramways Committee for the carriage of the raw material in the industry from its source to the manufactory. Of 100 horse-carts and wagons, 80 had been taken off the roads, and the Leeds Corporation would be carrying goods to the extent of 50,000 tons per annum by the end of the year. It had paid his company, and he believed it had paid the Leeds Corporation. The development of this idea would prove of great national value. As to railways, he believed their great extension in the future would be towards electrification.

Mr. A. H. Scott (London) suggested that something very tangible might be done towards the reduction of food prices if municipalities were able to provide facilities for bringing agricultural produce direct from the urban districts to their own public markets.

Mr. Ellis, in reply to the points raised, pointed out that at Leeds the Corporation Tramways Committee had been able to do much in the way of developing goods traffic for war work through the present system, by which it was only necessary to convince the responsible Minister that the extension was a desirable one in the national interest, for not only permission to be given to go on, but valuable wayleaves and privileges to be obtained. It would be a pity if something of this sort did not continue after the war. In considering the extension of tramways into outlying areas, it was very necessary that something should be done to protect the public against the enhanced value of the land along the route. When there was any suspicion of a tramway being extended the land was bought up, so that future development was retarded by exorbitant prices.

Business Meeting.

The annual business meeting followed, at which the report and balance-sheet were adopted. The President made reference to the loss which the Association had sustained by the deaths of Ald. J. Brodie, J.P. (chairman of the Blackpool Tramways and Electricity Committee), and of Ald. J. Miles, J.P. (chairman of the Bolton Corporation Tramways Committee, and a former vice-president).

Ald. S. Flint, J.P. (chairman, Leicester Tramways Committee), the Vice-President, was unanimously elected President, and Mr. T. B. Goodyer (manager, Croydon Tramways) was elected Vice-President.

Mr. A. Baker (Birmingham) and Mr. J. M. McElroy (Manchester) were re-elected members of the Executive Council. For three vacancies for councillors or aldermen there were nominated Ald. Spencer (Halifax), a retiring member, Ald. R. Wood (Stalybridge), Coun. R. Mayne, J.P. (Newcastle), Coun. J. Timpson (Portsmouth), and Ald. W. G. Wylie (South Shields). The three first-named were elected.

Mr. J. F. Simpson (Preston) was re-appointed auditor, and Messrs. E. R. Pickmere (town clerk, Liverpool) and Mr. S. F. James (town clerk, Ilkeston) hon. solicitors.

On the proposition of Mr. Baker, the Association placed on record its appreciation of the valuable services rendered as hon. secretary and treasurer by Mr. C. J. Spencer, of Bradford, who had resigned his office, after five and a half years' successful work, in order to take up duties under the Admiralty. It was decided that Mr. Spencer be elected hon. treasurer.

Mr. A. R. Fearnley (Sheffield) was elected hon. secretary, and was heartily thanked for his services.

The new President, Ald. Flint, moved, and Ald. Wylie (South Shields) seconded, a vote to Mr. Mozley for his services in the chair, and thanks to the Mayor and Corporation of Blackpool for the welcome and facilities given for the conference were heartily accorded on the proposition of Ald. F. A. Dunsford, J.P. (Southampton), seconded by Coun. Fryer (Birmingham). Mr. Charles Furness, Blackpool's borough electrical engineer and tramway manager, fittingly replied. Later the delegates were entertained to luncheon by the Blackpool Tramways Committee. Coun. R. Holt, J.P., the Deputy-Mayor, and chairman of the Committee, presided.

From every point of view the conference was distinctly successful, and the view was expressed that in future, as before the war, it ought to extend over three days in view of the many important tramway questions which call for discussion and decision.

WAR ITEMS.

Glass Order.—In the "London Gazette" for September 21st will be found a copy of the Glass and Glassware Order of the Ministry of Munitions, prohibiting the manufacture, supply, or delivery of any chemical or electric lamp glass, &c., except under specified conditions. Full explanatory notes are given.

The Cockerill Works.—"Les Nouvelles," of Maastricht, states that the Germans are completely destroying the Cockerill ironworks at Seraing-sur-Meuse. The iron girders have been removed, and all the blast furnaces are being blown up.—*Times.*

War-time Wages in Germany.—The "Labour Gazette" in an article on "The Course of Industrial Wages in Germany during the War," gives the following figures relating to wages in the metal, engineering, electrical, chemical, and pottery groups of industries:—

Trade group.	Average earnings per day. Men. March, 1914.	Men. Sept., 1916.	Men. Inc. %	Women. March, 1914.	Women. Sept., 1916.	Women. Inc. %
	s. d.	s. d.		s. d.	s. d.	
Metal	5 5	7 11	44·5	2 0	4 0	99·5
Engineering	5 3	7 11	48·9	2 3	3 10	70·2
Electrical	4 5	7 4	64·6	2 3	4 9	74·5
Chemical	5 1	6 9	34·2	2 4	3 6	50·4
Stoneworking and pottery	4 5	5 4	21·3	1 8	2 2	31·1

"Owing to the limited number of industrial concerns covered by the inquiry, as well as to disturbing influences resulting from war conditions, the German Department of Labour Statistics are of opinion that any conclusions drawn from the foregoing figures as to the movement of the level of wages in German industry during the war must necessarily be subject to certain reservations. No reference is made in the source to the question as to how far increased earnings may be due to the working of overtime.

Protected Trades Certificates.—At Bermondsey, attention was again drawn to the indiscriminate granting of certificates under the Protected Trades Schedule, when a warehouseman, employed by a firm of Lancashire cotton waste manufacturers, stated he had received a certificate, although no application was made for it either by his manager in London or by himself. It was sent to him from Lancashire. The Military Representative said he had to draw attention to the granting of four certificates under the Trade Protection Schedule. Three men were described as unskilled labourers, two 20 years old, both single men, and the other 28 years old, whilst the fourth was an unskilled millhand, 18 years old, all having obtained certificates. Coun. W. Shearring said the granting of these certificates in this indiscriminate way was most unfair to traders and large employers of labour, and also to the Tribunal, who were called upon to send married men with large families into the Army. The Military Representative said if a firm was on the Government list they automatically received protection cards for all their employés over 19 years of age classified B1 (garrison duty abroad), or in the lower medical categories, no matter what the men did. The Tribunal decided to ask the Badges and Protected Trades Department to receive a deputation on the question within the next fortnight. If no reply was received or a satisfactory solution arrived at in the meantime, the Tribunal decided that they would suspend the hearing of all further applications for exemption.

Municipal Tramwaymen in the War.—A return submitted to the members of the Municipal Tramways Association, at their meeting last week, showed that of 84 municipal authorities replying to the queries, the number of tramway employés at normal times was 55,208, and that 29,268, representing a percentage of 53, had joined the Forces. The amount paid to dependents of employés serving with the Forces totalled £1,437,603, or an average allowance per man of 11s. 4½d. per week. The amount collected on the cars for various national and other objects was £84,509, and tramway employés had contributed £38,170 to various relief funds. On 76 systems women conductors were employed, the number totalling 11,757, and on 18 systems there were women drivers numbering 611. Twenty-six undertakings employed auxiliary drivers, male, these totalling 564.

A French Advisory Council.—According to the "Board of Trade Journal," there has just been published in a French journal the text of a Presidential Decree of September 9th, creating a Conseil Supérieur des Travaux Publics ("Superior Council of Public Works") to examine and advise on the chief technical, economic, and financial questions coming within the province of the Ministry of Public Works (Under-Secretariat of State for Transports). The Council is to consist of (1) the members of the existing Conseil Général des Ponts et Chaussées; (2) members of Parliament and of certain important public and quasi-public administrative bodies; and (3) 21 members appointed by the Minister of Public Works from professional associations concerned in the execution and the development of public works. The Council is to be divided into four sections, of which the first will deal with matters relating to roads, traffic regulation, motor vehicles, and the distribution of electric energy; the second will deal with questions affecting navigation, the management and utilisation of water and water-power (floods, hydraulic works, &c.); the third, with matters relating to ports (works, the regulation of harbours and lighthouses, the provision of buoys and beacons, and coast erosions); and the fourth with matters affecting railways.

After the War.—Dr. Addison, Minister of Reconstruction, addressing a meeting at Huddersfield, said that whatever steps were taken to deal with the problems of reconstruction, we must rely in the main on people helping themselves. The Germans had been busy at the work of reconstruction for some time, and they had been endeavouring in different parts of the world to secure the supply of raw materials that our people would need. They were still making extensive efforts to acquire control of great mineral deposits. They had even tried to buy them in England during the war! Dr. Addison said that the unemployment problem ought not to be so formidable as it looked, but we must prepare to cope with the difficulties that might arise. Over a million men who were fighting would have their places kept open; another large class would be immediately required on shipbuilding and the railways at home and abroad. There would be big demands in many trades, but the provision of raw materials was essential. Shortage of ships had aggravated the shortage of some materials. The more the traders did for themselves to remedy this the better he would be pleased, and he proposed to consult the traders themselves as to how best to do it. It was of great national importance that the manufacturers should overcome their differences and co-operate. The Government had had as one of their chief difficulties the securing of such co-operation. In the past we had not made enough use of brains. Highly trained scientific men who had overcome the difficulties of supplying our armies, had in the past been paid salaries which were a disgrace. Increased productivity was the only way to overcome war's devastation. To secure such increased productivity we needed:—Co-operation between Capital and Labour; better conditions of life; better training; and better industrial methods. One of the chief reasons why Germany had invaded our markets was by organisation in buying and in selling; we must do the same. As a result of his examination of the results in factories where efficiency prevailed, he was able to mention one case where although wages had increased by 20 per cent., production costs had fallen by 29 per cent.

Mr. G. H. Roberts, Minister of Labour, speaking in London on Sunday, referred to plans for the return of soldiers to civil life. He recognised that public opinion would not tolerate procrastination in this matter. The men were recruited for the duration of the war, and they were formulating plans for carrying out that undertaking; but, of course, it would take some time. They might have to enjoin patience, but everything practicable would be done to expedite demobili-

sation. The men for whom situations were waiting would be returned earliest. Every man would have a month's holiday with full pay and full allowances. The men would have the right of unemployment benefit at the rate of *at least* 10s. per week. They were going to increase the number of Labour Exchanges and extend their functions. In regard to munition workers, the plans were not so complete, but they would be dealt with on very similar lines.

To be Wound Up.—The following company is to be wound up under the Trading with the Enemy Amendment Act, 1916 :—

The Chicago Raw Hide Co., Ltd., Hythe Road, Willesden, London, N.W., machine belting manufacturers. Controller, A. P. Ford, 4B, Frederick's Place, Old Jewry, London, E.C.

Exemption Applications.—At the Marylebone Tribunal, Mr. V. J. Malton, aged 29, married, C 2, electrical contractor, of St. John's Wood, applied for further extension. He had been given four weeks' extension to enable him to find work of national importance, but, being offered as a substitute, had refused to take a job because he was offered 9½d. an hour instead of 1s. 1d., the Trade Union rate. The Military Representative said that Malton would be an exceedingly useful man in the Army. The Tribunal thought the man would have been wise to accept 9½d. The Army wanted men who could do the work that he could do. The application was refused.

Bexhill-on-Sea Tribunal, after a review, has granted six months' conditional exemption to W. H. Wakefield (38, B 3), clerk at the Corporation electric light works.

The Hull Tribunal has granted exemption until January 1st to a brake adjuster appealed for by the Corporation tramway department. The man is the only adjuster left for 100 cars.

At Lewes, on a review, conditional exemption held by a shift engineer (26, Class A) at the electric light works was cancelled, and three months substituted. The man stated that he joined the Army two years ago, but was sent back to civil work.

At Buxton, an electrical engineer who appealed stated that he was in poor health, and would break down if he had to join up. He was exempted until March 13th. Similar time was given to two other electricians, and a third had his appeal respited for a month to enable him to secure a Trade Protection Certificate.

Before the West Kent Appeal Court, renewed exemption was sought by F. Butcher (34), electrician, of Bexley Heath. The appeal was dismissed, and time to enable him to wind up his business affairs was refused.

At Deptford, four months' exemption was allowed to E. Brown (39), who is in sole charge of the electrical machinery at a local cattle food works.

At Brighton, a firm of electrical engineers, appealing for an electrician (39, B 2), stated that he was the only man left out of a staff of 18. He was employed on hospital and Government work, and the absolutely necessary installations for business people. Three months were conceded.

At Folkestone, a review was made of the case of A. H. Jenkins (31), chief clerk to the Electricity Supply Co., Ltd. Col. Daniel said that a suitable substitute in the person of a clerk from a bank had been found, but the company would not accept him. The substitution authorities considered that the substitute could have been given a month's trial. On behalf of the company, it was stated that the man sent as a substitute was not fitted for this particular work, and was evidently inefficient. Exemption was continued until a suitable substitute is found. The same decision was arrived at in the case of Mr. Dixon (21), switchboard attendant. In this instance, the substitute offered was 48 years of age, and had left the Twickenham sub-station on the ground of ill-health, and was not fit for any position needing experience and initiative. Other substitutes refused were a man recommended for direct-current work only, and a telephone fitter and jobbing electrician.

Dartford Rural Tribunal has granted six months' exemption to F. H. Luff (30), electrician, of Stone.

At Tring, the Grand Junction Canal Co. applied for exemption for J. Mead (24, Class A), charge hand of the electrical plant at Tring Ford. Exemption until October 7th was allowed.

At Bath, Military appeals were made against E. J. Cooke (35, C 1), electric tram driver, and H. Shrubsole (32, Class A), fitter and spare driver, employed by the Electric Tramways Co. The manager said that Shrubsole, although an inspector, had been doing fitting, &c., owing to the number of men released for the Army. In the case of Cooke, conditional exemption was continued, and in respect of Shrubsole the appeal was allowed, and the certificate of exemption cancelled.

At Southwark, Messrs. Hotton & Hodgson, electrical engineers, applied for the further exemption of F. W. Hotton, son of one of the principals, 26 years old, fit for garrison duty at home (C 1). He was described as an engineer, but Mr. Hotton, sen., claimed that his son was in a certified occupation, as he was a tool setter, having served his apprenticeship to tool making and setting. He was solely employed now on this work. He was granted conditional exemption as being in a certified occupation, on condition that his indentures of apprenticeship were produced for inspection.

BUSINESS NOTES.

The Trade of Guatemala.—The U.S. Consul in Guatemala reports that in manufactures of iron, copper, tin, and lead, and their compounds, the United States supplied during 1916 over 93 per cent. of the import trade, the increase in electrical goods more than equalling Germany's loss; but, he adds, after the war American manufacturers may have to meet vigorous competition in these lines, especially as Germans control the largest electrical installation in Guatemala, and their concession is practically a monopoly. The further development of electric lighting and power in small units on the larger coffee, cane, and other plantations, offers an opportunity that can be safely sought. "Ninety-five per cent. of Guatemala's industrial and agricultural machinery was imported from the United States in 1916. There is a decided preference for American industrial machinery, but as the country is purely agricultural there is little demand for other than repair machinery and small power plants for sawing lumber and cleaning coffee. As the most progressive 'fincas' or plantations are owned or managed by Germans, machinery of German make was preferred before the war. This handicap has been largely overcome, and, with careful handling, the trade can be held by the United States. All the railway material imported in 1916 was of American manufacture, as the railroads of Guatemala are owned by American capital. Other lines are projected, and the market for their supplies will be competitive."

Electrical Affairs in Jamaica.—According to an American Consular report, American manufacturers furnish most of the electrical supplies and equipment used in Jamaica. The imports are grouped separately under two headings, as follows :—(1) Apparatus necessary for generating, storing, conducting, converting into power or light, and measuring electricity; and (2) telegraph and telephonic wire and apparatus. The imports of both groups fall under the list of articles admitted duty free. During 1914 the imports of the first group amounted to £10,250, and in 1915 to £6,804, and the second group to £1,393 and £1,318 respectively. The reason why American equipment represents a large percentage of the imports is that in many instances the original installations consisted of American equipment. In Port Antonio district, embracing the parishes of Portland and St. Mary, there is one electric light plant and one telephone exchange, both located in Port Antonio. Both plants are relatively small, but well equipped. The Port Antonio Electric Light Co. has a capacity of 190 KW., and furnishes electricity for lighting purposes only at the rate of 1s. per KW. There is no demand for electricity for power purposes. The Port Antonio Telephone Co. has 52 instruments installed in the town. Practically all the supplies required by the local trade are handled by the operating company. In general, the equipment is much the same as that in use in the United States, although somewhat antiquated. This applies particularly to lamps, switches, telephone instruments, &c. Electrical accessories such as irons, fans, vibrators, and cooking utensils have no sale, owing to the fact that the local electric light plant operates at night only.

Trade Inquiries.—Russia.—An engineer at Ekaterinodar, who proposes to open, after the war, an office and depôt for the sale of machinery, &c., desires to receive catalogues, placards, illustrations, photographs for lectures and for lantern slide advertisements from United Kingdom electrical and engineering firms and works manufacturing electrical goods, &c. Name and address can be obtained from the Department of Commercial Intelligence, 73, Basinghall Street, E.C. 2 (Reference No. 333).

Denmark.—A Copenhagen firm which intends to inaugurate a commission business wants to get into touch with United Kingdom manufacturers of electric cable, various kinds of wires and wire rope, brass, copper, chinaware, &c. British goods only are to be dealt in to replace German goods, which are still prominent. Activities will be extended to cover Scandinavia, and eventually Russia. Name and address from the Department, as above (Reference No. 334).

Auction Sales.—Mr. T. H. Griffiths will sell by auction on October 3rd, at Longton, Stoke-on-Trent, the premises, machinery, and effects recently in the occupation of Messrs. Adams Bros., electrical engineers, Longton. For particulars see our advertising pages to-day.

The Assets Auction Co. will sell by auction on October 3rd, at 129, Newington Causeway, London, the stock of an electrical goods factor. For particulars see our advertising pages to-day.

France.—Under the style of Société Franco-Americaine Scholak, Varda et Cie, there has been formed in Paris, at 6, Avenue Perrichont, a company with a capital of 52,000 fr., for the manufacture of electrical apparatus.

The Société X. Huschard et Cie., of 10, Rue Nouvelle, Paris, electric suppliers, has been dissolved.

There has just been established at Nanterre (Seine), 18, Route de Cherbourg, a company with a capital of 1,500,000 fr., whose objects are the manufacture of all kinds of electric accumulators and their accessory apparatus.

Bankruptcy Proceedings.—Oxley, H. H. (otherwise Oliver Huxley), consulting engineer, Ealing.—Trustee released September 14th.

Liquidation.—Colston Electrical Works, Ltd., Bristol.—Liquidator (C. H. King) released September 14th.

Trade Announcements.—MESSRS. L. W. WILD & E. P. BARFIELD have disposed of their rights governing the Wild-Barfield process of steel hardening to Automatic and Electric Furnaces, of 6, Old Queen Street, Westminster, S.W. 1, who are manufacturing and installing complete equipments (furnaces, quenching apparatus, instruments, &c.) for carrying out precision hardening. Mr. Barfield is managing director. An illustrated booklet has been issued describing the equipment.

MESSRS. CREED & CO., LTD., announce that by the mutual agreement of the parties concerned, the arrangements for the acquirement by them of the wireless interests of the Indo-European Telegraph Co. and of the printing telegraph business belonging to Mr. Donald Murray, have been cancelled. The board of Creed and Co., Ltd., now consists of Mr. F. G. Creed (chairman), Mr. W. Arthur Coulson, and Mr. Nicol Paton Brown.

Electrical Trade in the Transvaal.—The Johannesburg Chamber of Commerce, in its review of trade conditions in 1916 in Johannesburg and the Province of the Transvaal, stated that the general feeling in the electrical trade was that, 1916 being the third year of the war, business had been exceptionally well maintained. Indent orders for the heavier electrical goods suffered, but the volume of business was satisfactory, and the increased costs due to manufacturing difficulties, extra freight rates, and insurance had not had an appreciable detrimental effect upon the demand for the smaller lines of electrical machinery, cable and wires, and electrical supplies. The total imports of electrical material into the Union of South Africa, of which about 40 per cent. was shipped to the Transvaal, were £472,287 in 1915 and £715,898 in 1916, divided as follows:—Electric cables and wires, £111,789 and £237,341; electrical fittings, including posts, £182,192 and £298,064; and electrical machinery, £178,306 and £180,493.

These figures include imports from neutral countries. The year was sharply divided into two well-defined periods as regards competition. During the first six months, when there were also considerable stocks available, the competition was quite keen; in the latter portion of the year, with the mining groups once more buying heavily and local stocks becoming gradually depleted, trade was brisk and prices attractive. During 1916, owing to the several causes previously suggested, there was an increase in the price of megohm wires, 30 per cent.; armoured cables, 50 per cent.; and motors, 25 to 30 per cent. There was hardly any difference in the prices quoted for metal filament lamps during 1916, but every indication of a sharp rise in 1917.

Hackney Carbon Contract.—The Hackney Electricity Committee has agreed to relieve the General Electric Co., Ltd., from the obligation of completing the balance of arc lamp carbons due under a contract of 1914, on the condition that the company guarantees to supply the Council with 600 240-volt half-watt type lamps at the list price in force on the date on which delivery may be effected after the removal of the Public Lighting Restrictions, subject to a preferential discount of 28 per cent., and to give such order priority. The company has accepted the condition. The contract for the carbons of different dimensions was at 60s. and 70s. per 1,000 pairs in 1914, but owing to increased cost of material, wages, &c., the ruling prices per 1,000 pairs are now £12 4s. 6d. and £10 respectively, which would mean a very serious loss to the company under the original terms.

Book Notices.—"Tramways and Light Railways Association Journal." September. Contains a copy of the Munitions of War Act, 1917.

Catalogues and Lists.—BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—List No. 2,255 A (eight pages), containing an illustrated description, with tabulated dimensions, of their type DQ continuous-current motors.

MR. GEORGE ELLISON, Wellhead Lane Works, Perry Barr, Birmingham.—Two catalogue lists detailing apparatus recently developed to meet a definite demand; No. 27 (10 pages), gives full description, with illustrations, diagrams, weights and dimensions, and prices in shillings, of disconnectors for A.C. and C.C. circuits up to 750 volts; No. 28 (eight pages) deals similarly with trailing cable sockets and plugs for oil-break gate-end boxes for the same circuits and voltages.

LIGHTING AND POWER NOTES.

Australia.—As terms could not be agreed upon between the Kerang (Vic.) Electric Supply Co. and the local Shire Council for the purchase of the company's electric lighting plant for £5,580, the Council has decided to accept the offer of the Falkiner Electric Co. for the supply of a plant at £3,685.—*Tenders.*

Bray (Co. Wicklow).—PRICE INCREASE.—The Council has decided to increase the charge for electrical energy by 10 per cent. to meet the advance in cost of fuel oil.

Bury (Lancs.).—PRICE INCREASE.—The Electricity Committee has decided to advance the charges for electricity for lighting, power, heating, and tramways by the addition of 5 per cent. to each account. The advance comes into operation on October 1st, and the charges will then be 20 per cent. over the pre-war standard for lighting, heating, and tramways and 30 per cent. for power.

Cavan.—The Board of Guardians have communicated with Mr. J. P. Tierney, electrical engineer, Dublin, with regard to the proposed introduction of electric lighting in the workhouse buildings, and the question whether suction gas or oil plant should be used.

Continental.—NORWAY.—The city of Stavanger has decided to take a 10 years' lease of the 12,000 H.P. that is being developed by a private Norwegian company at Florli, on one of the neighbouring fjords, commencing in January, 1918, when the scheme is expected to be in working order. The price is $12·06 per H.P.-year. Similar leases were effected in 1914, at $7·50 per H.P., but it is necessary that the municipality should have as much electricity as possible at its disposal, owing to a possible shortage of fuel during the coming winter, as the city's present supply of hydro-electric power is insufficient and the plans for further utilising the available falls which the city owns cannot be carried through for some time. The company's power will be transmitted over very difficult country to the lake where the city's power station is situated, the line being carried on wooden poles straight up over the steep mountain side to a height of about 2,500 ft. above the fjord; one span alone will be a mile long, crossing the Hogsfjord, and saving a distance of 18 miles. The scheme will finally be built for 50,000 volts, but for the present about 30,000 volts will be utilised.—*U.S. Commerce Reports.*

NETHERLANDS.—The increased cost of coal has made it necessary to raise the prices of gas and electricity supplied by the Amsterdam municipal works. Electricity has been supplied, according to the quantity used, at 12 to 15 Dutch cents for light and 8 to 10 for power per KW.-hour. These charges it is now proposed to increase by 5 Dutch cents for light and 1½ cents for power.

Faversham.—PRICE INCREASE.—The T.C. has decided to increase the charges for electricity by ½d. per unit.

India.—An application has been made to the Madras Government by Messrs. Best & Co., of Madras, for authority to establish an electric lighting and power installation in Madura, 344 miles from Madras.

Launceston.—PRICE INCREASE.—The T.C. has decided not to oppose the application of the Launceston Electric Supply Co. to the B. of T. for power to charge a maximum of 8d. per unit for the supply of electricity.

Monasterevan (Co. Kildare).—STREET LIGHTING.—The Athy No. 1 District Council has accepted the tender of Mr. R. Griffin for the lighting of this town by electricity, 200-C.P. lamps to be used. A supply of current will be available also for business people and private residents. Hitherto Monasterevan has been lighted by oil lamps.

Morley.—BULK SUPPLY.—Owing to the heavy loss on the Corporation electricity works, several members of the Corporation are of opinion that the time has arrived when the question of purchasing energy in bulk should be considered, instead of generating it as at present.

Newport (I. of W.).—STREET LIGHTING.—The T.C. has accepted the offer of the Electric Light Co. for public lighting until further notice, at a charge of £30 per quarter.

Nuneaton.—PRICE INCREASE.—The T.C. has decided to increase the pre-war charges for electricity by 33⅓ per cent. for the quarter commencing September 30th, and to apply for sanction to a loan for money expended on plant, mains, and services.

Oban.—PRICE INCREASE.—The rate for electric lighting has been raised from 7d. to 8d. per unit; for power to ordinary consumers, from 4d. to 4½d. per unit, and to large consumers, from 1¾d. to 2½d. per unit; and for heating, from £1 per KW. plus 1d. per unit to £1 per KW. plus 1½d. per unit.

Rochdale.—STREET LIGHTING.—The Electricity Committee is suggesting that the problem of street lighting during the winter shall be partly met by the provision of arc lamps, supplied with current from the tramway overhead wires, on the main tramway routes. In the event of an alarm the lights would be extinguished when the current was switched off from the cars.

Salford.—DOCK EQUIPMENT.—The Manchester Ship Canal Co. proposes to carry out improvements at the Salford Docks, including the putting down of electrical plant for various purposes.

South Africa.—CAPE TOWN EXTENSIONS.—The City Council proposes to erect additional stores, workshops and offices for the E.L. department, at a cost of £16,940, and to install additional plant sufficient for the estimated requirements of the next 25 years, including the electrification of the suburban railway from Cape Town to Simons Town, and the energy required for tramway purposes. The plant that the power station will accommodate, with the alterations and additions now contemplated, it is estimated will deal with a demand of 24,000 KW., being five times the maximum present load. The purchase of the following new plant is recommended:—Additional 3,000-KW. turbo-alternator, £20,000; 1,000-KW. motor-generator for town and dock supply, £5,500; 400-KW. converter for supply of docks, £2,500; one boiler (35,000 lb. of steam per hour), £14,000; one boiler (17,500 lb. of steam per hour), £9,500; steam piping, £2,000; two turbo boiler feed-pumps, £900; wet air filters, £500; extra-high-tension and low-tension switchgear and protective devices, £30,000; additional bank of transformers of 11,000 volts, £2,000; and one of 2,200 volts,

£250; contingencies, £8,460; making a total of £95,610. It is also proposed to spend £68,000 on distribution cables.

Johannesburg: Compulsory Unionism.—Recently the Amalgamated Society of Engineers notified the T.C. that unless the non-unionists employed at the municipal power station joined the Union or were dismissed, there would be a strike; there were about 200 mechanics employed at the station, of whom all but 14 were members of the Union. The general manager, on the instructions of the Tramway and Lighting Committee, issued a notice calling on all non-union men in the gas and electricity departments to join their respective Unions by July 31st last, or their services would be dispensed with. At a meeting of the T.C., the action of the Committee was discussed, and after a long debate a motion was carried disapproving of the Committee's action, and ordering the immediate withdrawal of the notice. It is reported that the non-union employés have now joined the A.S.E.

Durban.—Year's Working.—At a recent meeting of the Municipal Council, the Mayor (Councillor J. H. Nicolson) said that the electrical department had had another successful year, the revenue totalling £125,000, being £11,000 in excess of the estimates, while it was not likely that the expenditure would be more than the estimated figure, and, after contributing largely to the borough fund and making adequate provision for renewals, sinking fund, &c., a handsome surplus would accrue as a result of the year's working. The units sold would be 22,000,000, as compared with 20,000,000 for the preceding year and 15,000,000 units for the year immediately preceding the war; the figures demonstrated the wisdom of the T.C. in deciding early this year to adopt the borough electrical engineer's recommendation to take steps to increase the power station plant by installing a 3,000-kw. turbine and generator, at an estimated cost of about £20,000, including all accessories. The tender of the British Westinghouse Co. was accepted for this plant, but, unfortunately, the company found they were unable to execute the contract owing to the rapid advance in the cost of materials and labour, and the order was finally placed with the B.T.H. Co., at £14,500, about £150 more than the Westinghouse original price. It was anticipated that the machinery would be installed in such good time that the usual development of the undertaking would not be interfered with.

During the year some difficulty had been experienced in obtaining the necessary supplies on account of the irregularity of shipments, but fortunately last November the present shortage of materials was foreseen by the borough electrical engineer, and heavy stocks of all kinds were bought in, with the result that they were still able to meet all demands both from existing and new customers. For a long time past the only other large municipal electrical undertakings in the country—viz., Johannesburg and Cape Town—had not only had to refuse to make any new connections, but had to restrain customers already connected in their consumption of electricity; one satisfactory aspect of the situation, however, was that the department had been thrown more upon local resources than ever before, and expedients had been adopted bringing into use local productions, which would be of permanent benefit even after the war.

During the year the Council decided to obtain opinions from its consulting electrical engineers in England (Messrs. Merz and McLellan) on a number of points. In the course of their replies, the engineers stated that, in order to arrive annually at the minimum amount which should be set aside out of revenue on account of obsolescence, the following percentages should be taken:—Power station plant, 5 per cent.; power station buildings, 2½ per cent.; underground mains, 1½ per cent.; overhead mains, 2 per cent.; services, nil; sub-station and transformer equipments, 3 per cent.; sub-station buildings, 1½ per cent.; public lighting, electrical instruments and tools, and electric vehicles, nil.

The Rand.—The chief engineer of the Rand Water Board, in his annual report, states that the policy of shutting down the electrical plant at Zwartkopjes and Zuurbekom pumping stations during thunderstorms, as a precautionary measure against damage to the plant and machinery by lightning, has again been followed during the year under review. The plant was shut down on 71 occasions, aggregating a total of 257 hours, and damage to a total amount of £145 was done to the plant. During the previous year the plant was shut down on 100 occasions for a total duration of 230 hours, and damage amounting to £146 was done.

Southend-on-Sea.—L.G.B. Inquiry.—The L.G.B. has informed the T.C. that a local inquiry will be held relative to the application for sanction to a loan of £45,520 for additional generating plant.

Tonbridge.—Overhead Mains.—The U.D.C. has applied to the B. of T. for consent to supply electricity by means of overhead lines outside the present area of supply. The Ministry of Munitions has advanced a loan of £18,130 for electricity extensions.

Walsall.—War Bonus.—The Committee of Production has decided that the war bonus to male employés of the Corporation gas and electric supply departments shall be increased to 12s. per week for those aged 18 and over, and that in the case of youths and boys under 18 there shall be a further advance of 1s. 6d. a week.

Wharfedale.—Electricity Supply.—At a meeting of the Council, last week, the clerk reported that the Electrical Distribution of Yorkshire, Ltd., was again urging the Council to agree to the company's application for powers for lighting the district. A little while ago the Council was approached, and decided to adopt a neutral attitude. The clerk had suggested to the Finance Committee that he might meet the company's officers to see whether any new facts could be advanced, and the Council approved of the suggestion.

Willesden.—Bulk Supply.—The U.D.C. has received a letter from the North Metropolitan Electric Power Supply Co., stating the terms upon which it would be prepared to afford a supply of electricity in bulk for a minimum period of 15 years. The Electricity Committee is not satisfied with the offer, and the company is to be asked to supply energy in bulk for a period of three years from March 31st next at the prices now being paid under the agreement dated March 31st, 1910.

TRAMWAY AND RAILWAY NOTES.

Australia.—Tramway Statistics.—The progress of electric traction in the Commonwealth during the year 1915-16 is shown in recent figures of transportation issued by the Statistical Branch of the Commonwealth. The advance has been greatest in Victoria, where the mileage route open for traffic increased from 70½ in 1914-15 to 85. Queensland increased its mileage by about two, Western Australia by three, and Tasmania by two miles. The total capital cost of all the systems increased by £926,928, from £12,784,130 to £13,721,058. The energy generated totalled 120,206,835 kw.-hours, compared with 117,127,000 kw.-hours the previous year. The car-miles covered increased from 42,576,000 to 43,335,672; the gross revenue advanced from £2,939,703 to £3,047,736, while the working expenses increased from £2,178,142 to £2,240,611. The number of cars, motors, and trailers increased from 2,120 to 2,165. There are now 13,214 men employed in the service, against 12,223 for the year 1914-15. The total route mileage is 406.

Tramcar Lighting.—The Melbourne Tramways Board, after investigation of various car-lighting systems over a period of 12 months, has decided to light the cable tramcars by electricity, and tenders have been invited for the equipment of cars, &c., with a storage-battery system, the batteries being charged during the day by dynamos installed at the various car-sheds.

The Prahran and Malvern Tramway Trust reports that the total revenue from passenger fares for the 16 weeks ended June 27th last, amounted to £51,890, car-mileage 869,332, passengers carried 8,009,963, and revenue per car-mile 14·411d.; average operating costs per car-mile 10·619d. The report adds that the equipment of the cars with excess-speed alarms has had the effect of regulating the speed at which cars travel, and of reducing the cost of maintenance of armatures of the electrical equipment.—*Melbourne Age.*

Bradford.—Wages.—The women employés of the Corporation, to the number of 1,400, have applied, through the Council of Municipal Women Employés, for an early revision of the scale of bonus, and ask that the present and any future scale shall apply equally to men and women, contending that the cost of living is as high to women as to men, but that the women's bonus is only 6s. as against the men's 12s. They have secured the support of the local Trades and Labour Council.

Brighouse.—Wages Award.—The B. of T. arbitrator's award in a recent application for increased pay by the Corporation employés is not satisfactory to the latter. The award was that the standard rates should stand as they were. Within a fortnight the workers, through their Union, have put in a demand for an increase of 15s. per week. The Corporation, in view of the circumstances, has decided to forward the correspondence to the Chief Industrial Commissioner.

Continental.—Italy.—The Italian Government has made an inspection of the water courses in proximity to the Italian railway lines, and decided that sufficient water power exists for the electrification of numerous lines, thus economising fuel.

Doncaster.—War Bonus.—The award of the Committee on Production, arbitrating between the Corporation and its employés in all departments in respect of the demand by the latter for an addition of 1s. per day to their wages, grants 4s. per week extra to all men and women over 18 years of age, and 2s. per week to those under that age. Any females whose work brings them under the Munitions Acts are not affected, as they are dealt with under those measures. It is understood that their pay is to be increased to a minimum of 27s. per week.

Edinburgh.—New Tramway.—The Tramway Committee has had under consideration the proposed electric tramway to Queensferry, and the burgh engineer has been instructed to prepare plans of the proposed routes, and to submit a report to a later meeting of the Committee.

Halifax.—Fares.—Tramway fares are again under consideration, a special Sub-Committee having been appointed last week to inquire into and report upon the advisability or otherwise of increasing the fares. The Committee proposed higher fares some time ago, but the T.C. did not agree.

Morecambe.—Electric Traction.—After controversial debates in meetings during several years past, on the subject of the change of the old horse tramway system to some form of mechanical traction (electricity being the most favoured), the T.C., last week, decided in Committee to promote a Bill in Parliament for powers to adopt mechanical traction on the Front and in other parts of the town. In the meantime, as no wholesale transfer from horse to electric power can be made until after the war, the Council further decided to meet present needs by purchasing two electric buses as soon as sanction could be obtained. The vehicles will probably be on the Edison accumulator principle.

Newcastle-on-Tyne.—Electric Vehicle.—At a meeting of the Town Improvement Committee of the Corporation, on the 19th inst., it was decided to purchase an electrical wagon for the removal of house refuse, at a cost of £1,123. A statement submitted by the acting city engineer showed that on 41 weeks' working of the present wagon there was a saving of £195 as compared with the cost of horse haulage.

Salford.—Year's Working.—The annual report of the Corporation tramways for the year ended March 31st shows gross income 284,443 ; working expenses, £187,515 ; allowance to men on service, £16,711 ; gross profit, £80,217. After deducting payments to local authorities, interest and sinking fund, &c., totalling £79,250, there remains a net profit of £967, which has been carried to the renewals fund. During the year 58,801,870 passengers were carried, an increase of 2,343,604 on 1916 ; miles run, 5,673,639.

South Lancashire.—Fares.—The South Lancashire Tramways Co., whose system covers about a score of important colliery districts in Southern Lancashire, raised their fares by about 25 per cent., on the average, on Monday. Many hundreds of miners and other colliery workers are affected by the increase.

Venezuela.—La Guaira Harbour Corporation, which owns and operates the Macuto La Guaira-Marquetia Electric Railway, is considering a scheme for developing power from a stream near Galipan. The company's engineer considers that 300 H.P. can be obtained, which will be sufficient to operate the cars and the shops of the electric line and the harbour works.

West Ham.—Competition.—The tramway manager (Mr. Lewis Slattery), in a report, says :—"It is inconceivable why no restriction is placed on competition with tramways ; such would not be tolerated with other municipal trading departments. In my opinion, all municipalities should have statutory powers to license and define routes of all competitive services, if such are deemed requisite, and to regulate fares and fix charges for the maintenance of the roads traversed by such services."

TELEGRAPH AND TELEPHONE NOTES.

Canada.—Employés of the G.N.W. Telegraph Co. are striking for equal terms with the Canadian Pacific Co., and 70,000 operators are affected, in offices from the Atlantic to the Pacific.—*Daily Telegraph.*

Postal Servants.—Employés of the Post Office are to present a demand for the raising of their war bonus to 15s. a week for every full-time servant, male or female, and also for its conversion into wages. Up to the present the Post Office Associations have secured war bonuses ranging from 3s. 6d. to 8s.

Wireless Telegraph School.—A school for training wireless operators was opened in Leeds on Monday, in connection with the general campaign for the production of operators for the merchant fleet. It is hoped that Leeds will supply about 200 of them. The school is in an upper storey of premises adjoining the Education Committee's premises. The class numbered 30 at the opening, but further applications are being received daily, and a larger lecture-room is being equipped, containing a complete installation. Mr. R. E. Barnett, head of the Leeds Technical Schools, estimates that the Leeds quota in the present emergency demand will have been supplied to the service in nine months.

CONTRACTS OPEN AND CLOSED.

OPEN.

Kirkcaldy.—October 2nd. Corporation. Converting plant and switchgear. See "Official Notices" September 14th.

CLOSED.

Aylesbury.—U.D.C. Extensions to electricity works : Messrs. Webster & Cannon.

Tonbridge.—U.D.C. :—

Western Electric Co.—Cables.
Bennis & Co.—Stokers, &c.
Willans & Robinson.—Diesel engine and dynamo.
Veritys, Ltd.—Switchboard extensions.

NOTES.

Industrial Development and Research in South Africa.—The honorary committee of scientific and technical men appointed recently by the Government, to advise upon matters concerning the industrial development of the natural resources of the country, of which Mr. Bernard Price is chairman, is taking active measures to ascertain the present extent of knowledge regarding these resources, and to extend and accelerate the work of surveying them. Reports on more than 50 separate subjects have been requested from scientists and others throughout the country, many of whom are Government officials. Advertisements have also been inserted in the public Press, requesting information bearing on the subjects of these reports from all persons who have special knowledge thereon. The reports and data thus obtained will provide a basis on which to initiate further investigation, but without waiting for such information, the committee is already satisfied that an acceleration of certain survey work is urgently needed, and steps are being taken to hasten the completion of the survey of the mineral resources of the country and of water power. In order that the information and data collected by the committee may be widely disseminated for the benefit of the country, and with the object of stimulating industrial development, the committee has recommended to Government that a Journal of Industries should be established. Reports and statistics on various subjects, after publication in this journal, would be abstracted and reprinted in bulletin form, and these bulletins would be obtainable at a nominal price by everyone interested in the subject concerned. The committee is also dealing specially with specific questions referred to it as urgent matters by the Minister of Mines and Industries.—*S.A. Mining Journal.*

Electric Vehicles : A New Zealand Forecast.—The City electrical engineer of Christchurch is reported to have stated that the advent of the storage-battery for vehicular propulsion has opened a new era in that town, where there are already a number of electrically-propelled trucks and vehicles in use. He is of opinion that within five years after the close of the war, the town will have a fleet of five hundred electrically-propelled vehicles.—*Board of Trade Journal.*

Women's Work in Engineering.—There was opened on Wednesday afternoon at the Mappin Art Gallery, Sheffield, by the Lord Mayor of Sheffield, an exhibition of official photographs and samples of women's work in engineering and other industries of munitions of war. The exhibition, which is arranged by the Ministry of Munitions, remains open until October 9th. The collection, which it will be remembered was first exhibited in London and later in several provincial centres, has been considerably enlarged since it was shown at Newcastle. We are sure that our engineering readers in the Sheffield district would find a half-hour or more devoted to a study of these photographs and samples to be time very profitably and educatively spent.

Wages of Central-station Workers.—After considering a report of the proceedings at a Conference held on September 5th at the Ministry of Labour, presided over by Sir George Askwith, between representatives of the Associated Municipal Electrical Engineers (Greater London) and the Electrical Trades Union and the National Union of General Workers, the Hackney Borough Council Electricity Committee reports that there appears to be serious unrest prevailing throughout the electricity undertakings of Greater London at the present time, which is alleged to be mainly due to the delay on the part of various authorities in paying war wages awarded to the shipbuilding and engineering trades by the Committee on Production. "Workmen and junior officers appear to have joined up in the Electrical Trades Union to a very large extent, and this Union, with the National Union of General Workers, is bringing great pressure to bear upon the Ministry of Labour with a view to securing (1) a 48-hour week ; (2) increased normal pay equal to what is claimed to be paid in the Post Office, dockyards and other Government works ; (3) the Committee on Production's awards in the engineering trades as war wages."

The Committee states that the whole question was carefully considered at a meeting of the Associated Municipal Electrical Engineers (Greater London) held recently, when it was decided that steps should be taken to secure an agreement between the authorities and the Unions as to (*a*) hours of work, (*b*) minimum rates of pay, (*c*) war wages, and that there should as far as possible be uniformity throughout the London area. It was also recommended that each municipal authority in Greater London owning an electricity undertaking should appoint two (municipal) representatives and its chief electrical engineer to form a body which will be authorised (*a*) to treat with (1) the Electrical Trades Union in respect of uniform payment and conditions for electricians at power stations on the basis of the Union trade-card and in respect of the settlement of the war wages to be added to the wages which may be agreed ; (2) the National Union of General Workers (and possibly the Bricklayers' Union and the Workers' Union) for consideration of the wages of the semi-skilled and unskilled men employed at power stations controlled by Councils in the Greater Metropolitan area, having special regard to the possible principle of uniform payments ; and (*b*) to have power to refer points, failing agreement, to conciliation or arbitration.

The Hackney Electricity Committee recommends its Council to appoint two councillors, together with the borough electrical engineer, to act as delegates of and on behalf of the Borough Council upon the proposed body to be formed to treat with employés' representatives.

A Lady Electrician.—According to the *Staffordshire Sentinel*, Miss H. M. Pickston, a lady clerk employed in the chief electrical engineer's office at Stoke, was recently enrolled as the first lady member of the Stoke-on-Trent Engineers' and Engineering Students' Association. Miss Pickston qualified for admission under a recent rule, which requires success in an engineering examination in the case of women applying for membership, by obtaining a pass in the City and Guilds of London Institute examination in electrical engineering.

Calcium Carbide: Ministry of Munitions Order.—The Minister of Munitions has issued an Order taking possession as from September 24th of all calcium carbide in the United Kingdom except individual half-cwt. stocks. Nobody is permitted to sell or supply, except for the purpose of carrying out a contract in writing existing at the above date, or enter into any transaction or negotiation in relation to the sale or purchase of calcium carbide situated outside the United Kingdom, except under special Permit. Monthly returns have to be given of all calcium carbide held by them on the last day of the preceding month, of all purchased or sold by them for future delivery, and all calcium carbide delivered to them during the preceding month. No return is required where the stocks do not exceed half-cwt. Returns have to be sent and applications made, to The Controller of Non-Ferrous Materials Supply, AM2/H, Hotel Victoria, Northumberland Avenue, London, W.C. 2.

Electric Vehicles in Siam.—Mr. J. L. Hansen, of the Siam Electricity Co. of Bangkok, Siam, on a visit to the United States, informed the National Electric Light Association that his company had a fleet of five electric vehicles, two of which had been in use since 1904. These 13-year-old veterans are used for lamp delivery, while the larger trucks are used by wiremen, and for various other purposes. They are successfully operated by unskilled natives, and are found to be as economical a means of transportation in Siam as they are in this country. This electricity supply company is especially interesting, since it is not dependent on coal as fuel, but uses rice husks in its place, which is obtainable in almost unlimited quantities at a small cost. To provide against a shortage of rice husks the company keeps an oil tank for reserve fuel, but it is rarely needed.

The Siam Electricity Company's Electric Vehicles.

Electro-Harmonic Society.—The first smoking concert for the 1917-18 session of this Society is to be held on October 12th, at 8 p.m. The concerts are to take place in the Venetian Chamber of the Holborn Restaurant, on Fridays, as follows:—

October 12th.—Smoking concert.
November 16th.—Ladies' night.
December 14th.—Smoking concert.
January 11th, 1918.—Smoking concert.
February 15th.—Ladies' night.
March 15th.—Smoking concert.

Volunteer Notes.—County of London Volunteer Engineers (Field Companies).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel Clay, V.D., commanding:—

Officer for the Week.—Lieut. W. J. A. Watkins.

Monday, October 1st.—Drill and Elementary Bridge Construction for No. 3 Company, Right Half Company, 6.30. Signalling Class, 6.30. Recruits' Drill, 6.30.

Tuesday, October 2nd.—Physical drill and bayonet fighting, 7.30.

Wednesday, October 3rd.—Drill and Elementary Bridge Construction for No. 1 Company, 6.30.

Thursday, October 4th.—Drill and Elementary Bridge Construction for No. 2 Company, 6. Signalling Class, 6.30. Ambulance Class, 6.30.

Friday, October 5th.—Drill and Elementary Bridge Construction for No. 3 Company, Left Half Company, 6.30. Recruits' Drill, 6.30.

Saturday, October 6th.—Commandant's Parade for Route March and Drill. Parade at Headquarters, 2.45 p.m. Uniform. Recruits' drill, 2.30, with Corps Parade for Route March.

Musketry.—The Range at Belvedere Road will be open on Tuesdays, Wednesdays, and Thursdays, every evening between 5.30 and 7 p.m. All N.C.O.'s and men who have signed the "A" and "B" agreements are required to attend during this month to re-classify in order to enable the Corps to obtain the Capitation Grant. Preference will be given to those N.C.O.'s and men in firing. This does not apply to those who hold the proficiency badge.

By order) Macleod Yearsley, *Capt. and Adjutant.*

Russian Grant for Coal-Saving Electric Plant.—At a recent meeting of the Russian Provisional Government, a proposal of the Ministry of Ways and Communication was approved, granting 32,000,000 roubles for the construction of plant for using the water power of the River Volchoff. The installation of an electrical plant on the Volchoff will make it possible to economise 10,000,000 poods of coal a year, by which quantity the national trade balance will be improved.

American Copper Prices.—The *Daily Telegraph* correspondent in New York states that the agreement reached between the producers and the Government fixes the price of copper for the next four months at 23½ cents per lb., this price to be available to the United States and the Allied Governments and the public alike. "It is stipulated further that the producers will not reduce the wages of the miners, that they pledge themselves to maintain the maximum production, and prevent copper falling into the hands of speculators. Copper at 23½ cents is 3 cents below the existing market, more than 10 cents per lb. under the prevailing prices when the Government first undertook to fix the price, and about 10 cents above the pre-war average price. Generally speaking, the price is considered to be a fairly workable one, especially for large producers. Above all, the terms of the announcement indicate that the Government does not intend to reduce prices indiscriminately, but will endeavour to secure satisfactory agreements with the producers of raw materials, rather than enforce arbitrary price reductions by legal or administrative action."

Industry and Education.—A meeting will be held at the Institution of Civil Engineers on October 25th, at 3.30 p.m., for the purpose of considering the establishment of a central organisation for improvement in, and better co-ordination of, engineering training and the appointment of a representative Committee of engineering and educational interests to initiate action. Sir Maurice Fitzmaurice, C.M.G., president of the Institution of Civil Engineers, will preside, and representative engineers and educationalists have signified their intention to be present. Those interested are requested to obtain invitations from Mr. A. P. M. Fleming, British Westinghouse Co., Trafford Park, Manchester, or Mr. A. E. Berriman, chief engineer, Daimler Co., Coventry, who are acting as honorary organisers for the Committee responsible for arranging this meeting.

Engineering is one of England's most important staple industries, and it is of the greatest national consequence that all who are engaged therein from bottom to top should be representative of their highest respective types; this can only be secured when the proper purpose and value of education are not only recognised, but achieved, in the widest sense of the term.

Although engineering training has made great strides in the last 20 years, largely owing to the growth of provincial Universities and technical schools, and to the good influence of some of the more important engineering Institutions, it is a fact that the link between industry and education is not forged as closely as it should be in the interests of the State, and a strong nucleus of opinion has grown in favour of forming a central organisation for the purpose of promoting co-ordination as the best means to secure the improvement that is desired.

Household Coal.—All registered coal merchants in the metropolitan area have a stock of requisition forms, under the Household Coal Distribution Order, for every kind of house or premises. Application should be made by consumers to their usual merchant for these forms and further explanatory information. Any information which cannot be obtained in this way, can be afforded by the local coal overseer for the district in which the consumer resides. Each local authority in the metropolitan area has appointed a coal overseer, whose address can be obtained from the coal merchants. This address is usually at the Council Offices. It is not necessary that applications for forms and routine information should be addressed to the Metropolitan Coal Distribution Branch of the Coal Mines Department.

A Remarkable Defence.—Our correspondent at Cape Town writes:—"Charged with the theft of a motor from his employers, a respectably-dressed European youth made rather a remarkable defence. He explained to the magistrate that the motor used to catch fire when switched on, and a friend of his who was an electrician told him that it was a direct-current motor, and that 'we had turned on the alternating current'; he took the motor home for repairs, and it was now in perfect working order. Accused was reprimanded and discharged. The point is, however, that the building from which the motor was taken has no alternating-current supply, and no evidence appears to have been called as to this."

Sub-Station Attendants.—The twelfth course at the Northampton Polytechnic Institute for giving a preliminary training to disabled sailors and soldiers as sub-station attendants has just been completed, and a number of the men are awaiting vacancies. Engineers of supply undertakings having vacancies are invited to communicate immediately with Dr. R. M. Walmsley, Principal of the Northampton Polytechnic Institute, Clerkenwell, London, E.C. 1.

Russian Prices for Electrical Energy: Increase Authorised.—The Board of the Russian Electricity Department has prepared a project for varying the conditions for the delivery of electric current by central stations for public use, owing to the increased cost of raw materials, &c. Central stations, both private and municipal, are authorised to increase their prices according to a scale and conditions published along with this announcement. A certain proportion of increased profits consequent on this widening of price limits is to go to the Government.

Hydro-Electric Power in New Zealand.—The development of hydro-electric power was discussed by Mr. E. Parry, chief electrical engineer to the Public Works Department, at a Conference of the Council of Agriculture at Wellington. He held that the cost of any system of electric power distribution would be recovered within four or five years. In other words, the coal saved would be sufficient in that time to pay for the establishment of the plant. He supported his statements by showing what was being done on the Lake Coleridge system as applied to rural requirements for light and power, and said that this was only an example on a limited scale of what should, and he believed would, apply to the whole of the Dominion. He did not mean that less coal would require to be mined. On the contrary, the demand would be increased, and the collieries would be much more readily developed. Low-grade, refuse coal could be gasified at low expense, and so used through the agency of electricity. From peat, ammonia and oils could be extracted in connection with a system of electrical distribution. With a general system of electricity supply it would be a simple matter to develop and utilise the smaller and more uncertain water courses. With respect to electricity in agriculture, Mr. Parry showed that production could be greatly increased. Its application already had proved a paying proposition for the Government in the Taitapu district. In fact, the country was a better customer for electricity than the town, applying it to so many and various purposes, apart from lighting. Electricity as a motive power for all farm purposes was undoubtedly suitable. He hoped trials would be made at Lincoln College of electric ploughing. Milk could be sterilised by electricity, although at the moment it was in the nature of an experiment. A trial was being made of checking frost in orchards by electricity, with good prospects.—*Auck. Weekly News.*

An Electrical Canteen.—*La Nature* for September 8th prints some particulars of a type of canteen which is the most original of its kind in France. This electrical canteen has been equipped on most modern lines at the works of M. Citroën, a manufacturer engaged on Government contracts. Everything that can be done by means of electricity is so carried out in this model mess-room. The food is cooked in electric ovens, kept hot on a series of electrically-heated hot tables, and served by waitresses on electrically-driven trolleys.

Electric fans and ozonisers are installed in the dining rooms, thus adding to the comfort of the workpeople. It is claimed that it is possible to serve 2,700 meals in less than half an hour, and by having three sittings some 8,000 breakfasts or dinners can be provided. The kitchen staff numbers only 18 persons. The cost per meal—even with the high prices at present ruling in France—works out at 1.50 franc (say 1s.). Details are not given of the actual electric equipment.

Germany and Raw Materials for After-War Trade.—In its column "Through German Eyes," the *Times*, on August 28th, referred to Germany's discussion of the problem of raw materials in connection with reconstruction schemes, as follows:—"The German industrial and commercial interests are never tired of discussing plans for resuming operations with the utmost possible speed when the war is ended and the blockade is raised. Such discussions are especially lively when German 'peace offensives' are in progress. The Association of German Chambers of Commerce has now published a long resolution on the much-disputed question of the importation and distribution of raw materials. It appears that German traders are all very anxious to escape as soon as possible from Government control, but it is universally recognised, on the other hand, that, owing to the depreciation in the value of the mark, uncontrolled trading with foreign countries will be impossible. There are also disputes between traders who have concluded bargains for the supply of raw materials from foreign countries and traders who want all available supplies to be divided by the State. The compromise recommended by the Chambers of Commerce may be summarised as follows:—The removal of restrictions on trade is of the greatest importance for Germany's international trade. Restrictions upon the importation of raw materials should be confined to measures which are necessary for economising the resources of German shipping and German railways, and for raising the value of the mark. Where restrictions are necessary, they should be applied to any other goods rather than to important raw materials. The State should not attempt to control individual bargains by refusing means of payment, but should do everything possible to facilitate payments by means of foreign loans and credits and foreign money. During the period after the conclusion of peace, during which scarcity of raw materials continues, it is necessary, 'for social reasons,' to distribute raw materials as equally as possible, according to the capacity of particular concerns and the extent of their activities immediately before the war. The various industries should establish their own distribution centres, but these centres should not be given any monopoly of freight space and foreign money; they should 'leave the importation of raw materials as much as possible to free trading'; care must be taken to guard the respective interests of industry and trade. It is insisted that the compulsory fusions of businesses which have been effected under the Auxiliary Service Law should be abandoned immediately after the end of the war. The Chambers of Commerce are holding out against legislation which would compel employers to take back former employés on their return from the war. They express general approval of the Government proposals for demobilisation, and say that, in particular, it is much better to retain men with the Colours for a maximum period of four months, or until they have obtained definite employment, than to attempt any ambitious scheme of support for the unemployed."

Lighting Restrictions.—At Colne, on Monday, Mr. Alfred George Cooper, the borough electrical engineer, was fined 6s. for a breach of the Restriction of Lighting Order.

Appointments Vacant.—Testing assistant (45s.), for the Islington B.C. Electricity Department; book-keeper and invoice clerk (£110), for the Walthamstow U.D.C. Electricity Department; charge engineer for the North Metropolitan Electric Power Supply Co.'s Power Station, Willesden; general clerk for the Aberdare U.D.C. Electricity and Tramway Department; senior clerk (£160) for the Borough of Salford Electricity Department; switchboard assistant for the Stepney B.C. Electricity Department. See our advertisement pages to-day.

Fleetwood Council proposes to appoint an assistant electrical engineer at £150 per annum, rising to £175 in six months.

Organisation of Power Station Engineers.—We are informed that on Friday last, at a meeting of electric power engineers in the Birmingham district, it was decided that the Midland Electric Power Supply Engineers' Association be formed. It is proposed that the Association shall embrace the whole of the Midlands, and, later, join with similar organisations in other parts of the country. A further meeting will be held at Queen's Chambers, Snow Hill, Birmingham, on Friday, October 5th. Full particulars can be obtained from the hon. sec., Mr. P. J. Burgess, 21, Geraldine Road, South Yardley, Birmingham.

The C.A.V. New Electric Starter.—On Tuesday last a demonstration was given at the works of Messrs. C. A. Vandervell and Co., Ltd., Acton, of their new geared type of electric starter for motor-cars. The starter embodies an ingenious combination of two main principles with which the motor world is familiar—namely, the axial pull upon an armature which is not symmetrically situated with regard to the field magnets, and the use of a pinion working on a screw thread cut on the armature spindle; when the current is switched on, the armature moves axially and draws the pinion into contact with a gear on the fly-wheel, and as the armature revolves the pinion drops into mesh, and moves along the thread until fully meshed, when it is positively driven by the armature, and accelerates the fly-wheel. Directly the engine starts, the fly-wheel overtakes the pinion, and causes it to run back and disengage the gears. The starter is controlled by a plunger switch with two positions; the first starts the motor slowly and engages the gears, and when the plunger is pressed home the full power of the motor is applied. In the first position a momentary "dwell" is caused by a ball, backed by a spring, entering a recess in the spindle of the plunger. The whole operation is automatic and noiseless; the full power of the motor cannot be applied until the gears are fully meshed; no damage can possibly result from backfires, and the disengagement of the pinion when the engine starts is automatic and certain—once the engine is running it is impossible for the gears to remain in mesh. We are informed that the current consumption is extremely low; the starter is very light, strong, and simple, and no adjustment is required. It is made in three sizes, for cars and engines, ranging up to 150 H.P., and judging by the samples which we saw, it is extremely well designed and constructed.

On the same occasion we were privileged to make a tour of Messrs. Vandervell's works, which have been greatly extended, and are occupied with a variety of very important work; the completeness and efficiency of the organisation of the establishment were conspicuous features, and reflected the greatest credit on the staff of the company.

A descriptive pamphlet relating to the new machine appropriately bears the title, "Electric Starters—C.A.V."; as pioneers of the electric lighting of motor-cars in 1900 and of the variable-speed dynamo in 1904, the firm undoubtedly are "electric starters," and we may add that they are making the running and are certain winners.

Patents and Alien Enemies.—A list of some 24 German patents, mainly owned by the firm of Robert Bosch, is given in the *Illustrated Official Journal* (*Patents*) for September 26th, in respect of which application has been made to the Board of Trade by the British Lighting and Ignition Co., Ltd.

Electric Voting Machine.—The Argentine Government has been inviting tenders for the designing, manufacture, and installation of an electrical voting machine for the Chamber of Deputies of Argentina.

A Swansea Strike.—The *Times* says that a strike of steel workers at Briton Ferry, near Swansea, which arose over the dismissal of a foreman electrician, over 1,000 men being affected, has been settled, the men, after a conference with representatives of the Ministry of Munitions, deciding to resume, the matters in dispute to be referred to arbitration.

The Belfast Strike.—When the case of the 32 employés of the Belfast Electricity Department was again before the Belfast Munitions Tribunal on September 18th, it was stated that since the order adjourning the cases was made, the men, in accordance with their undertaking, had returned to work, and there had been no cause of complaint against them since. The President adjourned the case for another six months, to see if they would keep their undertaking. He said he hoped that the men would remember that for the offence they had committed they were liable to heavy penalties, and the question of whether or not those penalties would be imposed would depend largely on how they conducted themselves in the meantime.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Rochdale Tramways Committee has unanimously recommended that the salary of MR. G. WEBSTER, the general manager, shall be increased from £450 to £500. A return submitted showed that the existing remuneration was below the average paid in towns similar to Rochdale, and warm appreciation of Mr. Webster's services was expressed by members of the Committee.

MR. J. WILKINSON, tramway electrical engineer, Hull, has returned to business after a serious illness of several weeks' duration, and will be glad if his business friends will note his new address :—Tramway Power Station Buildings, Osborne Street, Hull.

MR. J. A. RAYNER, manager, Galway Electric Light Co., has been presented with a gold watch by the employés, and with a smoking cabinet by the Galway Rowing Club, on his leaving for Hereford. His successor in the Galway managership is Mr. Collins, of Dublin.

MR. HAROLD WM. SANDERS, A.M.I.Mech.E., chief draughtsman, Manchester Corporation Electricity Department, has been appointed assistant constructional engineer to the City of Birmingham Electric Supply Department, Dale End, Birmingham.

MR. C. J. TURNER, chief engineer and manager of the Hoylake and West Kirby U.D.C. electricity department, was recently granted a commission as lieutenant, R.N.V.R., and on the occasion of his leaving to take up his duties as electrical officer in the R.N.A.S. he was presented with a case of pipes and a cigarette case by the staff.

General.—MR. JOSEPH FLANAGAN has been appointed electrical engineer to the Tees-Side Bridge and Engineering Works, Ltd., Middlesbrough.

GOLDEN WEDDING.—The many friends of ALD. BRUCE, chairman of the Sunderland Electricity and Lighting Committee, will be pleased to learn that on Monday next, October 1st, he will celebrate his golden wedding, and will join us in congratulating him on that happy occasion. Ald. Bruce was elected a member of the Sunderland Council in 1879, and was elected an Alderman in 1896. He was Mayor of the borough for two years (1897-8), and has been chairman of the Electricity and Lighting Committee since its formation, about 23 years ago (which is probably the longest record for a chairman of an Electricity Committee, unless Ald. Pearson, of Bristol, can claim to beat it). He was a member of the I.M.E.A. Council from 1905 to 1914, when he retired under the new rule that requires a member to retire for at least one year ; he is also a director of the Municipal Mutual Insurance Association. Two of his sons are serving in France, both being lance-corporals, and the younger has been awarded the Military Medal. Under his wise guidance the Sunderland undertaking has been developed into a large and prosperous concern, and we trust for many years to come it will have the benefit of his matured experience and sound judgment.

Roll of Honour.—SAPPER ALBERT PENNY, R.E., who has died of wounds, was employed at the Salford Corporation electricity department.

PRIVATE S. D. DALBY, A.S.C., M.T., who has died from appendicitis in South Africa, was employed by Mr. George Newby, electrical engineer, Bradford.

MR. W. J. LARKE, assistant chief engineer at the Rugby Works of the B.T.H. Co., and lately engaged at the Ministry of Munitions, has been appointed an officer of the Order of the British Empire.

PRIVATE CECIL R. GIBBONS, Lancashire Fusiliers, killed in action, aged 20, was employed at the British Westinghouse Works, Trafford Park.

CORPORAL ARTHUR HALLIWELL, R.F.A., who was recently awarded the Military Medal, is in hospital in France, wounded. He was employed by the Lancashire Electric Power Co.

DRUMMER W. KIRKMAN, Royal Welsh Fusiliers, who has died of wounds, aged 32, was employed at the Bolton Corporation electricity works.

PRIVATE THOMAS TURNER, Duke of Wellington's Regiment, who has been killed, was employed at the Phœnix Dynamo Works, Bradford.

On Thursday, last week, at the Ediswan Works, LANCE-CORPORAL W. A. PRIME, of the 11th Batt., Middlesex Regiment, who was formerly employed in the Ediswan glasshouse, stamping and burnishing shops, was presented with an illuminated address, a gold watch, and a sum of money by Mr. J. W. Elliott, on behalf of the staff. Lance-Corporal Prime is only 18 years of age, but won the Military Medal on February 26th, 1917, and was wounded at Arras on April 10th, losing his right foot.

SECOND LIEUT. WM. H. PALMER, R.F.C., who met his death at Lincoln while flying, owing to the petrol-tank igniting, was an electrical engineer, trained at Finsbury College. He was the only son of Councillor W. H. G. Palmer, of Kingston-on-Thames.

SIGNALLER P. O. MEARS, London Regiment, aged 19, who has been killed in action, was a draughtsman with the Western Electric Co., Ltd., at North Woolwich.

CAPT. R. J. ROONEY, R.E., who was wounded by a bomb at the Front, and whose death has just been announced, was an electrical engineer practising in Scotland.

Obituary.—We regret to learn that Mr. C. M. Dorman, of Whitehall, Brooklands, Cheshire, chairman of Messrs. Dorman and Smith, Ltd., electrical engineers, Salford, has lost his only son, SAPPER HAROLD MARK DORMAN, R.E. Sapper Dorman, who was 19 years of age, and was stationed at Marlow-on-Thames, was accidentally drowned near Boulter's Lock, on September 9th.

The death has taken place, at the age of 64, of MR. WILLIAM ROBSON, of Messrs. Wm. Robson & Sons, electric lighting engineers, of Kirkdale, Liverpool.

The death has occurred of MR. ARCHIBALD WILSON, one of the partners of the firm of Messrs. King & Co., Leith Electric Works, Edinburgh, as the result of an accident on Saturday evening. Mr. Wilson was riding his motor bicycle, and collided with a commercial motor lorry. He joined the firm 26 years ago.

CITY NOTES.

German Companies.

The directors of the *Deutsche Elektrizitats Werke Garbe, Lahmeyer & Co., of Aix-la-Chapelle*, recommend a dividend of 6 per cent. for 1916-17, this comparing with 5 per cent. in the previous year.

The Kabel Werk Rheydt, A.G., of Rheydt, proposes to pay a dividend of 20 per cent. for 1916-17 on share capital of £250,000, as contrasted with 30 per cent. in the preceding year. At the same time the share capital is to be increased to £350,000.

The Internationale Stickstoff A.G., of Wiesbaden, which has had a nominal share capital of £103,000 since reconstruction in 1913, and had a debit balance of £46,000 at the end of 1915, is again to be reorganised by the reduction of the capital to £27,000.

The Hamburgische Elektrizitats Werke A.G., of Hamburg, reports a large increase in working expenses in 1916-17, and a decline in the net profits from £88,000 in 1915-16 to £52,000 last year. The dividend on the ordinary capital of £1,100,000 is proposed at 3 per cent., as contrasted with 6 per cent. in 1915-16, 11¼ per cent. in 1914-15, and 8¼ per cent. in 1913-14.

The Fabrik Isolierter Drähte (late C. J. Vogel), of Berlin, has decided to increase the share capital by £112,000 to £375,000, for the purpose of defraying the cost of additional machinery for the new works at Köpenick. The new shares are to be offered to present shareholders at the price of 148 per cent., they having already been taken over firm by a banking syndicate at 140 per cent.

The Akkumulatoren Fabrik A.G., of Berlin and Hagen, reports that the undertaking at Milan has been disposed of, and the value of the other interests in enemy countries has been entered in the accounts for 1916-17 at figures which exclude any risks. After allocating £4,000 to depreciation, as against £3,400 in 1915-16, the net profits are returned at £193,000, as compared with £138,000, permitting of the payment of 25 per cent., as contrasted with a dividend of 20 per cent. in the previous year.

The Isaria Zähler Werke A.G., of Munich, which belongs to the Brown-Boveri group, reports that in addition to the army orders received in 1916-17, the company endeavoured to increase the output of peace products as far as possible, these still forming the greater portion of the production. It was, however, impossible for sale prices of meters to keep pace with the growth in the cost of raw materials and of wages. After setting aside £11,000 for depreciation, as against £6,000 in 1915-16, the accounts show net profits of £24,000, as compared with £21,000. It is proposed to pay a dividend of 12 per cent., as contrasted with 10 per cent. in the preceding year.

Victoria Falls and Transvaal Power Co.

Mr. A. E. HADLEY presided at the annual meeting, held in London last Friday. He said that the net earnings were £70,000 higher than last year, enabling them to pay 5 per cent. on the ordinary shares, and to raise the dividend on the participating preference shares to the full amount to which they could become entitled, namely, 10 per cent. They had transferred from the balance standing to the credit of the profit and loss account as at December last £150,000 to a reserve fund, which was available to meet contingencies that might arise, to improve the property, to equalise dividends, or for any purpose conducive to the interests of the company. For the first time there was a reduction in the amount of the first debentures; the amortisation at the rate of 5 per cent. per annum fixed by the trust deed had now come into operation, and the amount of the first debentures drawn or purchased was £152,100. Dur-

ing the year a further £75,680 of second debentures had been redeemed by purchase. The position with regard to excess profits in the United Kingdom was clearer than last year, the pre-war percentage on capital having meanwhile been settled, and it had not been considered necessary to make any provision under that head in the 1916 accounts. Since the close of the accounts the financial legislation in South Africa had been greatly modified, throwing a heavier burden on the taxpayer. The modifications, while involving a reduction in the rate of the old income-tax, imposed a dividend tax, together with an excess profits duty at the rate of 25 per cent., calculated on the same general principles as adopted by this country. The taxation was retrospective, so as to apply partly to 1916, and a provision had been made to meet the charge in the accounts now submitted. In regard to engineering matters, the station generating plant for electric power and compressed air had run successfully and been well maintained during this period. The overhead transmission and distributing lines, and the consumers' sub-station plant, together with the compressed air pipe line, had been operated satisfactorily, and had been kept in a good state of repair. There had been no extension to the generating or distributing plant, other than a small pole line extension to a new consumer in the Brakpan area, the Sub-Nigel Co., the capacity of the generating plant being 270,680 H.P. The quantity of water for condensing purposes accumulated in the dams at the various generating stations remained normal, and showed no sign of shortage. The supply of engineering spare parts had presented difficulties, owing to the shortage of supply from this country, but this had been overcome in some cases by the increased output from the company's engineering workshops, while the provision of general engineering stores had, in spite of the difficulties of supply, been maintained. The prosperity of the company being so closely interwoven with that of the gold mining industry on the Rand, they had reason to follow with feelings of admiration the successful manner in which, in spite of the difficulties created by the war, the output of gold and the general activity of the mines had been maintained. The extra cost of materials, increased wages, taxation, and fluctuations in the supply of native labour impose heavy burdens both on their consumers and themselves, while neither of them was in a position to raise the price of its product. The foresight and energy displayed by those responsible for the conduct of the mines, assisted by the sympathetic attitude of the Imperial and Union Governments, had enabled these difficulties of obtaining the necessary materials to be overcome, and had prevented the supply of gold from the reef, so essential to the conduct of the war, from falling away. Naturally, these war conditions were reflected in the working costs, and were felt most severely by those mines working low-grade ore; but, nevertheless, by good management these mines had been kept working, and such mines as had been shut down during the period under review had either come to an end of their ore, or had closed through causes normally incidental to mining. The developments in the Far Eastern Rand, where several of their largest consumers were situated, continued to be satisfactory, and during the year the Union Government had leased two further areas in this part of the Rand, both of which were acquired by existing mining houses. The chairman expressed appreciation of the work of the company's staff and their associates.

In replying to shareholders' questions, the chairman said he could not at present make any statement about the prospect of an increased ordinary dividend. The profits for the present year had been going practically the same as last year.

To be Struck Off the Register.—The following companies will be struck off the register in three months unless cause is shown to the contrary:—

Absorbent Engine Cloth Co.
Eastern Electric Co.
Electrical Engineering & Motor Co. (Carlisle).
Marine & General Oil Engines.
Standard Bolt & Nut Co.
Transport Development & Power Syndicate.
Vanadium, Ltd.
X.L. Electric Co.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

Electro-Bleach & By-Products, Ltd.—120,000 ordinary shares of 10s. each, fully-paid, Nos. 1 to 120,000.

Calcutta Electric Supply Corporation, Ltd.—The units sold to consumers during the four weeks ended July 27th were 2,307,315, compared with 2,020,562 in the corresponding four weeks of 1916.

NEW COMPANIES REGISTERED.

Abrasives, Ltd. (148,486).—Private company. Registered September 19th. Capital, £10,000 in £1 shares. To carry on the business of manufacturers and factors of, agents for, and dealers in, metals, emery, emery stone, corundum, abrasives, polishing wheels, and the like, mechanical, electrical, and general engineers, &c. Agreement between J. S. Mitchell and B. R. Rowland & Co., Ltd., of the first part, W. M. Rowland of the second part, and the company of the third part. The subscribers (each with one share) are:—J. S. Mitchell, Hyland, Hargate Drive, Hale, Altrincham, Cheshire, engineer; W. M. Rowland, 24, Lancaster Road, Birkdale, Southport, engineer. The first directors are:—J. S. Mitchell and W. M. Rowland. Solicitors: Matthew, Hall & Thomson, 26, Victoria Street, Manchester.

E. O. S. Engine, Ltd. (148,451).—Private company. Registered September 13th. Capital, £4,000 in £1 shares. Mechanical and electrical engineers, &c. The subscribers (each with one share) are:—G. Patteson, Pinners Hall, E.C. 2, accountant; T. S. James, 16, Edith Road, Peckham, S.E. 15, engineer. The first directors are to be appointed by the subscribers. Solicitors: Francis & Johnson, 19, Great Winchester Street, E.C. 2.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Alfred Danks, Ltd.—Memorandum of satisfaction in full on September 3rd, 1917, of mortgage debenture dated May 6th, 1916, securing £6,000 has been filed.

Gorseinon Electric Light Co., Ltd. (39,944).—Capital, £10,000 in £1 shares. Return dated August 8th, 1917. 9,350 shares taken up; £2 paid; £9,348 considered as paid. Mortgages and charges: £780.

D. Hulett & Co., Ltd. (29,463).—Capital, £35,000 in £5 shares. Return dated August 8th, 1917. 6,000 shares taken up; £9,500 paid on 1,900; £20,500 considered as paid on 4,100. Mortgages and charges: Nil.

General Electric Co., Ltd. (67,307).—Capital, £1,400,000 in 80,000 pref. and 60,000 ord. shares of £10 each. Return dated July 31st (filed September 6th), 1917. 70,000 pref. and 50,000 ord. shares taken up; £380,000 paid on 63,000 pref. and 25,000 ord.; £320,000 considered as paid on 7,000 pref. and 25,000 ord. Mortgages and charges: £200,000.

STOCKS AND SHARES.

Tuesday Evening.

The City awaits with keen interest the Government's declaration with regard to more borrowing. In some quarters a new popular Loan is considered so imminent as to lead the prophets to look for its issue this week-end. In other directions, it is thought that the Loan may be postponed until after Christmas. The only effect that the discussion exercises upon current prices is in the Consol market, where the tone has softened somewhat. All other investment sections are very hard, while in some markets speculation is boisterously active.

Home Rails are enjoying one of their rare and lucid intervals, with prices firmer, and business more pronounced. The reason seems to be that other domestic investments of sober class are becoming difficult to find, while the Railway stocks of companies operating outside Great Britain are all out of favour for one reason and another. This tends to drive investment money into the Home Railway list, and the Undergrounds receive their due meed of attention. Amongst them, Central London assented stocks are noticed for their yield, and rises of 2 points have lifted the ordinary and the preferred ordinary to 60½. Metropolitan Consolidated advanced to 24¼, but reacted to 23¾! the company's deferred dividend stock is up 1 to 21. Underground Incomes remain at 82, from which price they will probably advance; the tide of London's traffic reminds one forcibly of the old lady who aroused the concern of the elder Mr. Weller at the famous tea-party.

The electric lighting market is firm, Bromptons holding their rise at 6½, and Metropolitans gaining 5s. at 65s. The demand for debenture stocks and preference shares is perhaps rather less insistent than it was, for which the coming of the new War Loan is doubtless responsible. People want to see what its terms will be before putting much money just at present into gilt-edged securities. But there is no pressure to sell, and the buyers of ordinary shares are as alert as ever for cheap stock. The sleepy special constable wonders where all the London searchlights draw their "juice," as he watches their beams while he is on duty; wonders too, it may be, if readers will forgive a short article as he sits down to it after the "All Clear" releases him for burning midnight oil of his own.

Marconis have developed renewed buoyancy, which arose first in the shares of the Marine Co., taking the price to 54s. before a slight reaction occurred. The parent shares rose to 66s. 3d., Americans to 19s. 3d., and Canadians to half a guinea. Business in Marconis is so spasmodic as to render an observer cautious of saying much about it, but the market view is certainly optimistic.

The telegraph group has no fresh feature this week, business being handicapped by the scarcity of supply of stock obtainable. Telegraph Constructions are 10s. better at 39, and India-Rubbers keep very firm at 13¾, shares being wanted at the price. Oriental Telephones have recovered their decline of last week, but United River Plates are still a trifle dullish.

Mexicans tend to halt. The dramatic rise in the price of silver is a bull point. The condition of the country calls for caution in putting money into Mexicans. Amongst the Utilities, Mexico Tramways Fives relapsed 2 points to 44½, but the remainder of the group keeps steady. British Columbia Electric Railway 4½ per cent. debenture stock has gone back to 50. The deferred and preferred issues are lower. Anglo-Argentine Trams are unchanged, the fatal railway strikes not affecting any of the tramway issues. A fair amount of speculative buying keeps Pernambuco Tramways

ordinary shares prominent, the present price being 7s. 3d. The 7 per cent. preference at 13s. and the 5 per cent. first debentures at 68 are firm. These latter look cheaper than the preference, as things stand at present.

British Aluminium shares have come back rather sharply, falling ½ to 32s. in consequence of a good deal of profit-taking. Other members of the miscellaneous group, however, are strong. Electric Constructions rose to 20s.; British Westinghouse Preference put on 5/16 at 3 1/16. British Insulated are strong at 14½. Babcock Ordinary advanced to 3½ buyers. Victoria Falls & Power shares are very quiet at 19s. 3d. for the ordinary and 23s. 9d. for the preference, the price being unaffected by the meeting at the end of last week. The chairman spoke in a vein of cautious optimism, and his remarks formed an appropriate corollary to the recent report. There has been a little business just lately in the 6 per cent. preference shares of the Madras Electric Supply Corporation, the price being about 17s. 6d. Vera Cruz ordinary are changing hands on the basis of 7s. 6d. Crompton preference at 14s. 3d. are a trifle harder; the ordinary remain in the neighbourhood of 10s. 3d.

The rubber market is animated, with prices strong. A large volume of business is in progress, interfered with to some extent, in the early part of the week, by the moonlight raiders. The price of the material fluctuates a little from day to day, keeping very close to the neighbourhood of 2s. 10d. per lb. More activity has come about in armament shares, Armstrongs and Vickers both being firmer. A good deal of trade, too, is passing in the shares of the companies connected with base metals, those of the tin group being especially prominent.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Sept. 25, 1917.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	9	8½	—	£6 18 6
Charing Cross Ordinary ..	5	5	9⅜	—	6 9 0
do. do. do. 4½ Pref..	4½	4½	32	—	6 18 4
Chelsea	4	3	2⅞	—	5 9 1
City of London	8	8	12⅞	—	6 4 5
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
County of London	7	7	11¼	—	6 5 10
do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	6	5½	—	5 14 8
London Electric	3	3	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8⅜	—	5 6 8
Metropolitan	8	8	8¼	+ ¼	4 12 4
do. 4½ per cent. Pref.	4½	4½	8¼	—	7 4 0
St. James' and Pall Mall ..	8	8	7	—	5 14 6
South London	5	5	2⅜	—	7 5 6
South Metropolitan Pref. ..	7	7	21/8	—	6 10 3
Westminster Ordinary	7	7	6⅜	—	5 5 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98½	—	5 1 10
do. Def.	33/6	1½	33	—	6 10 5
Chile Telephone	8	8	7⅛	—	5 11 4
Cuba Sub. Ord.	5	5	8⅜	—	5 14 3
Eastern Extension	8	8	14⅜	—	*5 8 4
Eastern Tel. Ord.	8	8	148¾	—	*5 7 9
Globe Tel. and T. Ord.	7	7	13	—	*5 7 8
do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	22	24	87	—	6 9 9
Indo-European	13	13	54½	—	5 19 3
Marconi	16	15	3⅞	+ 1/8	4 10 6
Oriental Telephone Ord. ..	10	10	8¼	+ ⅛	3 1 6
United R. Plate Tel.	8	8	6¼	—	*5 16 4
West India and Pan.	6d.	6d.	1/16	—	3 9 5
Western Telegraph	8	8	14½	—	*5 10 4
Home Rails.					
Central London, Ord. Assented	4	4	60½	+2	6 12 3
Metropolitan	1	1	29⅜	+ ½	4 4 6
do. District	Nil	Nil	16½	—	Nil
Underground Electric Ordinary	Nil	Nil	1½	—	Nil
do. do. "A" ..	Nil	Nil	6/-	—	Nil
do. do. Income	6	4	82½	—	*4 17 9
Foreign Trams, &c.	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 2 1
Anglo-Arg. Trams, First Pref.	5½	5½	3/16	—	8 19 6
do. 2nd Pref. ..	5½	—	2⅜	—	—
do. 5 Deb. ..	5	5	67½	—	7 8 3
Brazil Tractions	4	4	46	-1	—
Bombay Electric Pref.	6	6	9⅜	—	6 4 8
British Columbia Elec. Rly. Pfcs.	5	5	42½	—	11 15 4
do. do. Preferred	Nil	Nil	80	-1	Nil
do. do. Deferred	Nil	Nil	27½	-1½	Nil
do. do. Deb.	4½	4½	50	—	8 10 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	44½	-2	Nil
do. 6 per cent. Bonds	Nil	Nil	40	—	Nil
Mexican Light Common ..	Nil	Nil	22½	—	Nil
do. Pref.	Nil	Nil	31	—	Nil
do. 1st Bonds ..	Nil	Nil	45½	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3½	—	4 12 4
British Aluminium Ord. ..	7	10	1½	— ⅛	6 5 0
British Insulated Ord.	17½	20	14½	+ ½	7 0 4
do. British Westinghouse Pref. ..	7½	7½	3/16	+ 1/16	4 18 0
Callenders	20	20	14½	—	6 18 0
do. 5 Pref.	5	5	4½	—	6 1 8
Castner-Kellner	22	23	3/16	—	6 8 0
Edison Swan, fully paid ..	—	—	1½	—	Nil
do. do. 4 per cent. Deb.	4	4	72½	—	5 10 4
Electric Construction	7½	7½	1	+ 1/16	7 10 0
Gen. Elec. Pref.	6	6	10½	—	5 17 1
do. Ord.	10	10	17	+ ½	5 17 8
Henley	25	25	15	—	7 16 3
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	13½	—	*7 5 6
Telegraph Con.	20	20	39	—	*6 8 1

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 26th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	,,	£64	..
a Bisulphide of Carbon	,,	£23	..
a Borax	,,	£38	..
a Copper Sulphate	,,	£61	..
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	3/-	..
a Shellac	per cwt.	£12 10	10/- dec.
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers ..	,,	£35	..
a ,, Lump	,,	£26	..
a Soda, Chlorate	per lb.	10½d.	..
a ,, Crystals	per ton	130/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	..	..
c ,, Tubes (solid drawn) ..	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn) ..	,,	1/7 to 1/8½	½d. dec.
g ,, Bars (best selected) ..	per ton	£155	£5 dec.
g ,, Sheet	,,	£155	£5 dec.
g ,, Rod	,,	£155	£5 dec.
d ,, (Electrolytic) Bars ..	,,	£130	£7 dec.
d ,, ,, Sheets ..	,,	£157	£5 dec.
d ,, ,, Wire Rods ..	,,	£138	£7 dec.
d ,, ,, H.C. Wire	per lb.	1/4 7/16	7/16d. dec.
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	1/3	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	3/2½	..
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£42	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 8/-	..
e ,, ,, ,, medium	,,	2/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/9	½d. dec.
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	3/6	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Handling Coal with an Electric Truck.—Since the first of this year the Canton (Ill.) Gas and Electric Co. has been hauling coal to its electric and gas plants in an electric truck. The results, according to E. H. Negley, secretary and manager of the company, indicate that the investment was a good one, and that a considerable saving in coal-hauling costs is being made.

The haul from the railroad track to the company's electric plant is about three blocks long, and to its gas plant about 1·5 miles (2·4 km.). Over this distance this truck makes a round trip to the electric plant in about seven minutes, and can convey the contents of a 50-ton (45·5-t.) car of screenings to the station in about three hours. The round-trip haul to the gas plant requires about 30 minutes.

The speed of the truck loaded is about 7 miles (11·3 km.) an hour, and in ordinary operation it will cover from 15 to 25 miles (24 km. to 40 km.) a day, depending on how many trips are made. The truck is a Walker Vehicle Co.'s design with 44 cells of 31-plate Philadelphia storage batteries. It is said to be the first electric truck to be equipped with a Lee Loader Co.'s dump body; the dumping feature of this body has demonstrated its value at Canton, since the driver alone through the use of it can unload 10,000 lb. (4,536 kg.) of coal into the hopper in two minutes. The driver, who operates this truck exclusively, is responsible for its entire care, both as to charging and maintenance.—*Electrical World.*

Railway Electrification in South Africa.—In view of the attention which has been devoted of late to the possibility of certain portions of the S.A. Union Railways being electrified, and the general and increasing utility of electrical power, a large gathering assembled at the Durban Technical College on July 27th to hear a lecture on "Railway Electrification," by Mr. J. W. Kirkland, of Johannesburg, arranged by the Engineering Section of the Natal Society for the Advancement of Science and Art. The author told a graphic story of the Chicago, Milwaukee, and St. Paul Railway, which is the most important and largest instance of the application of electricity to railway operation, and which he has recently visited and inspected. He gave a summary of the advantages to be gained by the electrification of main line traffic, and in allusion to the practicability of adopting the system, so far as certain lines in South Africa were concerned, stated that the carrying capacity of the Natal line could be greatly increased by the electrification.—*Natal Mercury.*

ELECTRODES FOR ELECTRIC FURNACES: THEIR MANUFACTURE, PROPERTIES, AND UTILISATION.

(*Concluded from page 286.*)

Metallic and Compound Electrodes.—The use of vertical—or sole—electrodes of metal, or with a base of metal or secondary conductor, offers greater difficulties than the use of carbon electrodes, but it is essential in certain manufactures which necessitate the exclusion of carbonising materials to as great an extent as possible. On the other hand, it is sometimes desirable to incorporate certain ingredients of the final product with the electrodes to be used in its manufacture. Metallic electrodes facilitate cooling of pieces between which the arc plays; and compound electrodes are used where a conducting or semi-conducting medium is needed for special purposes.

Metallic Electrodes.—Tubular metal electrodes are used in several types of furnaces for the manufacture of nitric acid. In the Schonherr furnace, for instance, one electrode consists of a vertical steel tube of length proportioned to the power of the apparatus. The other electrode is a water-cooled tube of copper. At the centre of the second electrode there is an iron core which may be replaced

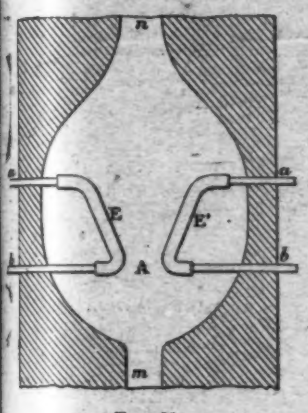
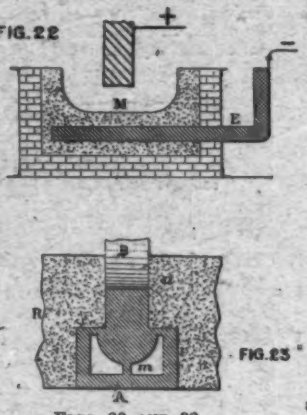


Fig. 21.



Figs. 22 and 23.

easily; its working life is about 2,000 hours, and replacement occupies only 15 minutes. The arc plays between the tube and the copper electrode.

The Moscicki furnace uses concentric electrodes, the external one being a copper cylinder 15 cm. in diameter, mounted in a clay base. The central electrode is a water-cooled tube 6 cm. in diameter, and

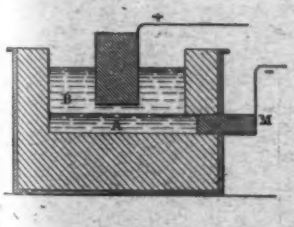


Fig. 24.

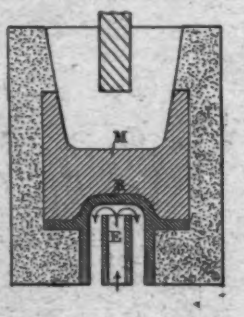


Fig. 25.

held at the top in a porcelain support. The arc plays between the two tubes, and is made to rotate by a magnetic device.

In the Birkeland-Eyde furnace the two electrodes are set in line. Each consists of a simple copper tube bent to U shape and water cooled. The electrodes wear very slowly, and are easily accessible and renewable.

Horn electrodes are used in the Guye & Pauling (fig. 21) for the synthetic manufacture of nitric acid. The electrodes E E' are of cast steel, and are made hollow to permit of water circulation. The arc is struck at A, where the electrodes are nearest together, but at once rises and spreads itself between the two horns. An air blast is maintained from *m* to *n*, and carries out with it the nitric products made by the action of the arc.

Massive metal electrodes are used in certain furnaces for the manufacture or fusion of metals. Such electrodes are preferably of the same nature as the metal to be melted, *e.g.*, iron electrodes in iron or steel furnaces, and copper electrodes in furnaces handling copper, bronze, or brass. In the simple type of melting furnace, illustrated in fig. 23, a large iron or copper electrode is embedded in packing M of carbon pisé, which forms the working bed of the furnace.

In the Gin "channel and basin" furnace which utilises the resistance of the molten steel itself, each electrode is formed of a block of soft steel A (fig. 23), terminating in the channel B of metal under treatment. The electrode is let into the refractory body B of the furnace itself, and has a circular cavity of the section shown at *m*, and through this circulates cold water. The cooling effected is sufficient to keep practically stationary the plane *a* of transition from the solid to the liquid steel of the same composition. A similar arrangement is employed in the Girod steel furnace, where a steel electrode M (fig. 24) is mounted laterally in the refractory body of the furnace. Fragments of the same grade of metal as it is desired to produce in the furnace are placed at A, and these, after solidification, protect the pole M, which is also water cooled. The space B forms the useful reducing and melting portion of the furnace.

Sole Electrodes.—Metallic bottom electrodes embedded in refractory, non-conducting material may be used in a number of ways differing more or less in detail. One of the first furnaces of this type was brought out by Siemens in 1880; two vertical electrodes were used, the upper one being of carbon and the lower one an iron rod fed forward by a screw mechanism in proportion to its consumption. In the Borchers furnace (1896) the steel bottom M (fig. 25) of the furnace chamber is mounted on a copper support B, which is cooled by water supplied through E.

The latest Girod furnaces employ electrodes which are either of graphite covered with metal or else entirely metallic. In the former arrangement (fig. 26), the object of the metal covering over the graphite is to protect the furnace charge against carbonisation. The poles P are embedded in the refractory brickwork of the furnace,

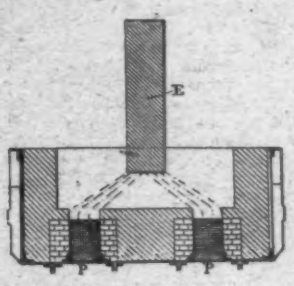


Fig. 26.

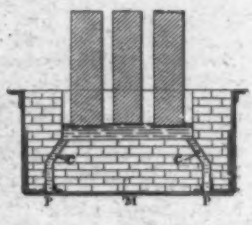


Fig. 27.

and the path of current flow from them to the upper electrode E is as shown by the dotted lines fig. 26—*i.e.*, such as to traverse the entire thickness of metal in the furnace. The alternative arrangement (fig. 27) employs several steel poles P set in canals in the masonry of the furnace and water cooled at their lower extremity. As in the furnace illustrated by fig. 24, the canals *c* (fig. 27) are filled with pieces of metal which melt and then form a protection to the actual pole pieces. The latter are connected in parallel outside the furnace, and the masonry is naturally of such material and construction as not to be rendered conducting by the heat to which it is exposed.

Compound Electrodes.—A furnace bottom of pure carbon often presents serious inconveniences, particularly in the electrometallurgy of steel. In the latter case, the carbon combines with the charge to such an extent as to make impossible the production of low-carbon metal. This difficulty may be overcome by using a magnesia bottom, but it is then necessary to allow for the fact

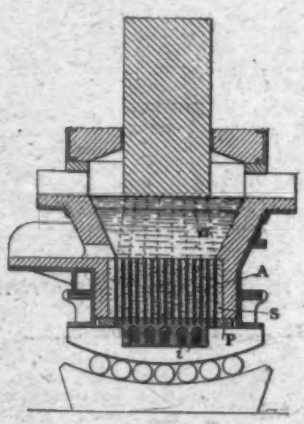


Fig. 28.

that magnesia is not an electrical conductor. A satisfactory compromise is to use a mixture of refractory non-conducting material (magnesia, dolomite, silica, &c.) with a carbonaceous, electrically-conducting binder of pitch, graphite and tar in various combinations.

No metallic conductor is used in this case, and the composition of the pisé may be varied so that the surface layers, in contact with the steel, contain insufficient carbon to carbonise appreciably the molten charge. This construction has been used successfully in the

Firminy steel works. Numerous mixtures have been tested, and it is found that the ingredients do not cohere well with less than 2½ per cent. of tar, whilst with more than 10 per cent. the mixture becomes too liquid. The mixtures most used are cast-iron turnings, tar and calcined dolomite, and graphite, tar and calcined dolomite. From these ingredients it is easy to make refractory floors containing 10 to 20 per cent. of carbon, which become very good conductors at high temperature after a preliminary heating, and then remain sufficiently good conductors for regular working to be commenced without further preliminary heating. Similar results are obtained if the dolomite be replaced by magnesia or siliceous sand.

The first melt from such a bottom naturally contains some excess of carbon, due principally to tar driven off during the early stages of heating. Analyses of consecutive melts of steel turnings, containing 0·16 per cent. of carbon, 0·36 per cent. of manganese, and 0·349 per cent. of silicon, gave the following results :—

	First melt. Per cent.	Second melt. Per cent.	Third melt. Per cent.
Carbon	0·226	0·102	0·140
Manganese ...	0·161	trace	0·073
Silicon ...	0·060	0·027	0·069

The second and third melts are normal, the carbon content being inappreciably affected by the electrode. The latter requires very little repair in service.

Compound Melting Electrodes.—This name is used to describe a type of upper electrodes due to Gin and containing the metal (or a compound of the metal), which it is desired to alloy with the molten material in the furnace. For instance, in the manufacture of ferro-tungsten there is used a furnace with two vertical electrodes in series composed of cast tungsten or of tungsten carbide. The furnace charge consists of iron oxide and tungsten dioxide. When the furnace is in action, the electrodes of tungsten carbide melt and their carbon burns at the expense of the oxides in the charge, which is thus reduced. The alloy obtained contains not more than 0·15 to 0·25 per cent. of carbon. Similar compound electrodes may be used in the manufacture of ferro-molybdenum.

Reinforced Electrodes.—Metal "reinforcement" is sometimes used in carbon electrodes with the double aim of increasing their electrical conductivity and their mechanical strength. Héroult, for instance, bores a hole through the electrode (axially) and fills it with an alloy of aluminium and silicon. The Plania Works (Ratisbon) introduces bands of copper or iron into the electrode before or after baking, this process being especially recommended for long electrodes, which are thereby much strengthened. Use is made sometimes of composite electrodes consisting of a tube of carbon or iron filled with lime, iron oxide, or other scorifier, which is thus carried, during the operation of the furnace, to the hottest part of the charge.

Keller Steel-Magnesia Electrode.—A bottom electrode which is absolutely non-carbonising and at the same time very strong and durable and of high electrical conductivity is shown in fig. 28. Iron bars A from 1 to 1½ in. square are set vertically and close together in a metal base plate P. A secondary conductor, such as magnesia, is made hot and rammed very tightly between these bars, thus providing an "armoured" block of refractory material which is very durable and of exceptional mechanical strength, whilst it has the advantage of permanent through conductors to secure low electrical resistance and easy starting from cold. The upper layers at least of the secondary conductor have appreciable conductivity when the furnace is working, and owing to this and to the distribution of the bars A in close spacing over the whole base of the furnace, current flow through the charge is exceptionally uniformly distributed. In spite of the large proportion of magnesia which gives the base its durability, the electrical resistance is almost nil. The metallic portion of the electrode is cooled by water circulation at *i*. The refractory material between the steel bars hardens in service, so that the whole is remarkably durable. Operation is certain and simple, electrically and mechanically, and it is unobjectionable from the chemical point of view. There is no appreciable industrial loss.

The author of the articles from which the foregoing abstract has been made is M. Jean Escard, Civil Engineer, Lauréat de l'Institut de France and of the Société d'Encouragement pour l'Industrie Nationale.

THE HIGH-TENSION MAGNETO.

At a meeting of the Aeronautical Society of Great Britain, on April 4th, Mr. A. P. Young, A.M.I.E.E., read a paper on "The High-tension Magneto, with Special Reference to the Ignition of Aeroplane Engines," which was printed in the *Aëronautical Journal* for April-June, 1917.

The paper is a lengthy one, dealing comprehensively with the various aspects of the subject, on which, as the author remarks, the amount of technical literature available at the present moment is very meagre. He points out that the degree of success achieved in the development of the combustion motor has at all stages been primarily dependent upon the efficiency of the ignition system used, and claims that the rapid strides which have, during recent years, been made in the construction of the petrol motor, *per se*, have mainly resulted from the very satisfactory high-tension ignition system that has been available. Without the high-tension magneto it is almost certain that the aeroplane would never have reached its present high state of development, and the whole course of the present disastrous war would have been different, and much less in our favour.

Prior to the outbreak of war, the number of high-tension magnetos being produced in this country formed a negligible proportion of the total number being used for a variety of purposes. Through laxity on our part, this most vital "key" industry was allowed to develop in Germany, but the war has taught us a lesson in this respect; during the period of the war the magneto industry in this country has developed at a really wonderful rate, and all those participating are to be congratulated on the present healthy and hopeful state of the industry.

The British Ignition Apparatus Association is at the moment supported by 10 British magneto manufacturers who have, during the period of the war, supplied to the Government for war purposes, and chiefly for aeroplanes, no fewer than 200,000 magnetos. The British magneto as at present constructed is the equal of the pre-war Bosch magneto emanating from Stuttgart, and certain developments now taking place will result in the British manufacturers producing new types of magnetos that will prove to be vastly superior to anything turned out of Germany in the past.

The author urges that when the war is over, British magneto manufacturers should be encouraged and supported by Government and public alike, so that there may be established on a solid foundation a British industry producing magnetos and ignition apparatus unsurpassed in quality and design.

After tracing the history of electrical systems of ignition from Faraday's discovery of electromagnetic induction in 1831 to recent times, Mr. Young turns to the technical aspect of the subject, and states that any form of high-tension magneto consists of four

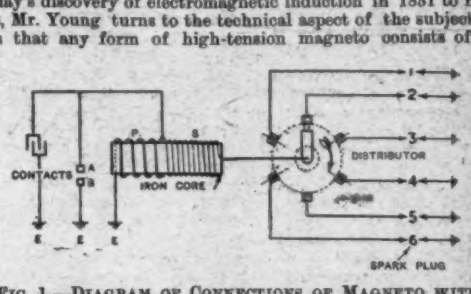


Fig. 1.—Diagram of Connections of Magneto with Six-Cylinder Distributor.

essential parts :—(1) A magnet system; (2) an iron core wound with primary and secondary; (3) a contact-breaker to interrupt the primary circuit at predetermined intervals; (4) a high-tension distributor.

The arrangement of connections generally adopted is illustrated in fig. 1. The earthed primary contact (B) is actuated by some form of cam, so that the primary circuit is continually being closed and opened.

The iron core which carries the armature windings may either revolve or be fixed. In the latter case, the rotor comprises certain iron masses so disposed that every 90° or 180° (depending upon whether the magneto is a two-spark or a four-spark), the flux flowing from the N pole of the magnet to the S pole, through the armature core, is suddenly reversed. When the armature rotates the flux reversal occurs—except when specially-shaped poles are fitted—every 180°, and the magneto gives two sparks per revolution. Magnetos provided with stationary armatures are said to be of the inductor type. The cycle of operations is as follows :—

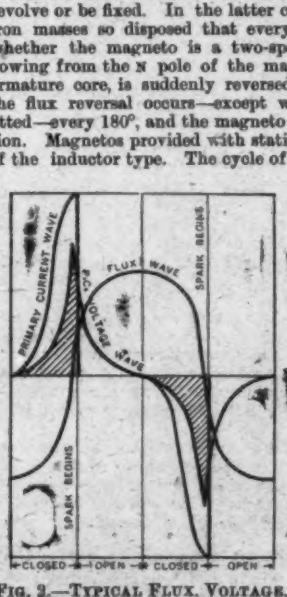


Fig. 2.—Typical Flux, Voltage, and Primary Current Waves for H.T. Magneto.

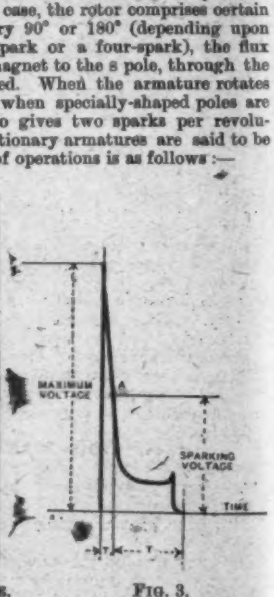


Fig. 3.

(*a*) The rapid reversals of flux in the armature core induce in both primary and secondary an alternating E.M.F., the maximum E.M.F. being reached for any given speed, when the actual flux in the armature core is substantially zero.

(*b*) The cam operating the contact breaker lever is so designed that the primary circuit is closed during the period when the induced voltage is growing from zero to its maximum value, and for some little while afterwards, but not until the voltage has become zero again.

(*c*) During the period of closure of the primary circuit the induced current will steadily increase in value. Then at a certain instant the contacts are suddenly separated by the cam. The condenser in parallel with them ensures that there is no sparking at this instant, consequently the rupture of the primary current is remarkably sudden.

(*d*) The sudden rupture of the primary current causes an instantaneous collapse of the magnetic field associated with it, and as this field is linked with the secondary turns, an enormous voltage is induced in the secondary winding at this instant. This voltage is sufficient to initiate a spark between the electrodes of the spark plug, and this spark is maintained, to some extent, by the voltage induced in the secondary by virtue of the continual flux change in the armature core produced by rotation during the period that the contacts remain open.

(*e*) After a certain short interval of time the cam allows the contacts to close again, and the cycle of operations (*b*), (*c*), (*d*) is repeated.

Theoretically, the whole of the energy stored up in the primary winding during the periods when the contacts are closed, and the primary current is creating a magnetic field, should re-appear in the secondary spark at "break" if there were no losses.

Actually, certain losses occur during the transfer, and only a portion of the energy stored magnetically appears in the H.T. spark. Generally speaking, about 80 per cent. of this energy is available for ignition in a well-designed magneto.

The maximum primary current for any given design is, within limits, proportional to the maximum armature core flux, this in turn being dependent on the magnetic characteristics and design of the magnets used. As the energy in the high-tension spark is proportional to the square of the primary current, the energy liberated at each discharge (that is, the intensity of the spark, but not necessarily the power of the spark to produce ignition) is proportional to the square of the maximum value of the flux produced in the armature core on open circuit by the system of magnets used. It is therefore evident that the magnet flux is one of the controlling factors in the design of any magneto, and very careful attention has been given to the magnetic quality of the magnets and the design of the whole magnetic system to ensure that the best results are obtained.

The rate at which the secondary voltage rises, and the value of the maximum reached, are dependent on the primary current broken; on the self-induction of the primary at "break"; on the ratio of secondary to primary turns; and on the characteristics of the magnetic circuit. It is necessary that the magnetic field created by the primary current shall instantly collapse at "break." A magnetic circuit which is totally laminated will ensure a more rapid dying-away of the magnetic field than will occur if there are in the magnetic circuit any solid masses in which eddy currents may be set up during the period of change, these eddy currents, by their reaction, tending to retard the rate at which the collapse of the magnetic lines occurs.

The character of the secondary voltage wave during the period of the high-tension discharge is of considerable importance, because the maximum value reached would seem to have some influence on the power of the spark to produce ignition. Furthermore, the shape of the wave controls, to some extent, the rate at which the energy liberated in the high-tension spark is dissipated, and the author holds the view that the rate of energy discharge is of more importance than the total amount of energy liberated, although the latter factor must be taken into consideration.

Experiments made on magnetos indicate that the voltage rise in the primary winding at the instant of "break" is very much greater than one would anticipate. It is reasonable to suppose from these experiments that a correspondingly abnormal rise of voltage occurs in the secondary at "break"—this voltage, of course, only being maintained for an infinitesimal period of time—and the curve shown in fig. 3 represents the way in which the author imagines the secondary voltage to vary during the period of the high-tension spark.

The voltage suddenly rises to a maximum and then suddenly falls again, the rise and fall occupying a time T_1, during which period there is no actual discharge between the electrodes, but the gases in the vicinity are being ionised preparatory to a discharge which occurs at the point A, and is maintained during the subsequent period T, at the end of which the voltage has dropped away to zero.

As soon as the spark is initiated at the point A the discharge is maintained to some extent by the voltage induced in the secondary winding in consequence of rotation, and this voltage is virtually superimposed upon the voltage induced as a result of the collapsing of the magnetic field stored in the primary prior to break.

Unfortunately, the present state of our knowledge concerning the process of ignition by means of a high-tension spark is by no means complete, but Mr. Young suspects that the maximum value of the secondary voltage reached is a controlling factor, and it is even within the bounds of possibility that the ionisation occurring as a result of the sudden application of an enormous voltage during the extremely small interval of time T_1 may in itself be sufficient to initiate the explosion. It has been demonstrated that ionisation in itself will produce an explosion, even though no spark occurs, and the apparent superiority of the polar inductor type of magneto over the rotating-armature type may be due to the fact that the secondary voltage wave is steeper and reaches a higher maximum during the interval T_1, in consequence of the armature circuit being more thoroughly laminated, and therefore allowing of a more rapid flux change.

A common trouble experienced with the ordinary type of distributor in which a carbon brush is used is that the carbon dust generated is liable to be ground into the brush track of the distributor, thus producing a path of low resistance between the segments, this disease being known as "tracking." In certain cases, and particularly when two six-cylinder magnetos are used in conjunction on a 12-cylinder engine, tracking of this kind is very liable to cause misfiring, because the spark, rather than discharge between the electrodes of the spark plug in the cylinder under compression, will leap along the surface of the brush track in the direction of rotation to the next segment which is connected to a spark plug in a cylinder at practically zero pressure, the resistance of this alternative path being extremely low.

Experiments have shown that even with a distributor that is badly tracked, misfiring can be entirely eliminated if, instead of the ordinary carbon brush, a metal brush be used, this being so arranged that there is a very small air gap (about 0·01 in.) between the face of the rotating metal brush and the distributor segment. The superiority of this arrangement over the distributor and carbon brush combination would seem to be due to the fact that the introduction of a small air gap in the high-tension circuit, such as is interposed between the end of the secondary winding and the outside circuit, completely insulates the secondary during the small interval of time T_1, and thus allows the voltage to rise to a very much higher maximum value than would be the case if there were any leakage paths of low resistance. This is a further confirmation of the view that the value of the maximum value of the secondary voltage at "break" is of vital importance. The spark-gap form of distributor has been tried with considerable success on aeroplane magnetos both in this country and in France, and is used generally on all the battery-ignition systems designed for automobile work in use in America. In the author's opinion it seems to be an advance in the right direction, provided that sufficient care is given to the design of the brush-holder and proper precautions are taken to ventilate the distributor, so that the products of ionisation resulting from the minute spark between metal brush and segments have easy means of escape.

The function of the magnets is to produce and maintain, in spite of the very severe conditions under which a magneto has to operate—including severe vibration and cyclic changes in temperature—a practically constant flux in the armature core. In comparing permanent magnets of different quality, it is usual to determine the remanence (B_r) and the coercive force (C_f). These factors apply to a closed ring of the steel, which is capable of being completely and uniformly magnetised. The remanence is the flux density in the steel, after the magnetising force H_{max} (usually 400) has been removed, and the coercive force is the demagnetising force that has to be subsequently applied to reduce this flux density to zero. The B.T.H. Co. accepts only those magnets which show on test a remanence and coercive force in conformity with the following:—

1. The product of remanence and coercive force in C.G.S. units must not be less than 580,000.
2. The actual coercive force must not be less than 55.

Experiment has shown that the active armature core flux in a magneto of given design is greatly dependent on the product of remanence and coercive force, or upon what the author terms the "magnet strength," using this expression to denote the factor $(B_r \times C_f)/10^4$. The spark energy output, being proportional to the square of the armature core flux, must in consequence be dependent on the magnet strength to a much greater degree.

The product remanence and coercive force is therefore a very important factor, and, generally speaking, it is sufficient when testing magneto magnets to measure this product only, because as a general rule a magnet which shows a product of not less than 580,000 will have a coercive force not less than 55. In other words, such a relatively low coercive force as 55 is usually associated with a remanence of the order of 10,500.

Looking at a magneto magnet from a purely mechanical standpoint, it is necessary that the pole faces, and also the edges, should be finally ground, after hardening, to a fairly fine degree of accuracy. It is of great importance that the ground pole faces be parallel to each other and exactly at right angles to the ground edges. The following limits are now being worked to by Sheffield manufacturers:—

Distance between the ground pole faces—Maximum + ·2 mm.
" " " —Minimum − ·2 mm.
Width of magnet—Maximum + ·15 mm.
" " —Minimum − ·15 mm.

These limits may at first sight appear to be large, but it should be remembered that a hardened tungsten-steel magnet is a very difficult thing to grind, particularly when it comes to grinding the inside pole faces, because trouble is encountered, due to the springiness of the magnet itself.

The author draws attention to the very excellent way in which the various Sheffield steel manufacturers now engaged on the manufacture of permanent magnets have carried out their work. Bearing in mind that at the outbreak of war practically no permanent magnets were produced in this country, and that this subsidiary key industry was entirely in the hands of Germans, the results so far achieved are very gratifying, and reflect great credit on the British steel manufacturers, who, by virtue of their resourcefulness and skill, have grappled so successfully with this difficult problem. His own experience is that at the present time permanent magnets for magnetos are being produced in this country which are quite equal—and in many cases superior—to anything that has been produced in Germany in the past.

(To be continued.)

LEGAL.

Glasgow Corporation Electrical Employes: Arbitration Case.

We have received a copy of arbitration proceedings between the Electrical Trades Union (on behalf of three of their members) as claimants, and the Glasgow Corporation Tramways Department as respondents. The Arbiter repelled the respondents' plea that the arbitration was incompetent, and found that the claimants were reasonably entitled to the advance claimed of 4s. per week upon their upstanding wage of 40s. The men, who were assistants known as "improvers," were promoted to take charge of stations when certain station charge hands were called to the Colours, and they had for a long period been doing the work of charge hands. The Arbiter stated that the claimants' training and length of experience as charge hands entitled them to the 44s., which was the recognised wage of a qualified charge hand. In addition to their upstanding wage the claimants receive war bonus additions amounting to 9s., but with that the proceedings were not concerned, as the dispute was only in regard to the upstanding wage. The money element was not the important question in the case. The respondents contested the claimants' claim for an advance upon a ground of principle which was novel, interesting, and important. The respondents' contention was that the claimants did not fall within the Arbitration Provisions of Part I of the Munitions of War Acts at all, and so the arbitration was incompetent. The provisions of Part I apply to "Any Employer" and to "persons employed" on or in connection with munitions work. The claimants were admittedly "persons employed," but the respondents contended that the expression "Persons Employed" had a limited meaning, and included only workmen who were paid on a time rate or a piece-work rate, which was subject to interruption by any cessation of work, and that it did not include men of the class to which the claimants belonged, who received an upstanding wage, which was not interrupted by their absence on holiday or through illness. All station charge hands such as the claimants, received an upstanding wage for a normal week of six shifts. If, owing to shortage of staff or other emergency, they required to work more than six shifts, they received, *pro rata*, extra pay. They were allowed a fortnight's summer holiday in the year without interruption of the upstanding wage, which also continued to be paid during absence through illness. But this domestic arrangement did not affect the question of principle which was raised in the case. It might be an element to be taken into consideration in fixing the amount of the upstanding wage, and he had taken it into consideration in finding that 44s. was a reasonable wage, but this was not an element in deciding whether the claimants fell within Part I of the Act. He was unable to accept the respondents' limited interpretation that the Arbitration privilege belonged only to what might be termed operatives, as distinguished from what were known as staff hands. The Act was not limited to operative workmen, but applied also to classes who were accustomed to be remunerated by an upstanding wage, and whose remuneration was not interrupted by absence on holiday or through illness. The leading purpose of Part I of the Act was to prevent a strike or lock-out occurring during the war. The Arbitration provisions were the counterpart of the prohibition-of-strikes provisions. Either an employer or an employé might seek the aid of the Arbitration provisions to settle a difference. It had, perhaps, not been a common practice for foremen, or clerks, or typists, or charge hands to take part in a strike so freely as operative workmen were inclined to do, but there was nothing to prevent these classes taking combined action to cease work for the purpose of compelling the adoption of working conditions, and, if they should do so, they would undoubtedly fall within Sec. 2 (1) of the 1915 Act, and become liable to prosecution. The claimants' freedom of action was restricted just in the same way as was that of a workman paid on a time or piece-work basis. The strike prohibition took no account of whether a person employed was remunerated by an upstanding wage, or otherwise. The policy of the statute was that every "person employed" who was under the restriction of Sec. 2 (1) had the corresponding privileges conferred by Sec. 1 (1). The Arbiter held that the claimants were entitled to the increase of 4s. which they sought from the date the difference was referred to arbitration.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

12,924. "Luminous electric light switch." C. D. S. Cranbo. September 10th.

12,925. "Device for winding telephone, &c., wire on to storage drums or reels." F. Fitton. September 10th.

12,938. "Insulation for windings of electrical machines, &c." R. L. Cleaver & Sandycroft, Ltd. September 10th.

12,957. "Ignition apparatus for internal-combustion engines." M.L. Magneto Syndicate & E. A. Watson. September 10th.

12,959. "Dynamo-electric machines." A. H. Law & Sir C. A. Parsons. September 10th.

12,961. "Magnetic chucks." W. Arter. September 10th.

12,960. "Electric starting and ignition of aeroplane engines, &c." Leyland Motors, Ltd., & J. G. P. Thomas. September 10th.

12,993. "Automatic time cut-off for electric, &c., power." W. C. Haigh. September 11th.

13,008. "Searchlights." A. C. Franklin, G. M. Roberts & W. Waller. September 11th.

13,019. "Apparatus for driving magnetos in connection with internal-combustion engines." Soc. Lorraine des Anciens Etablissements de Dietrich et Cie de Luneville. September 11th. (France, September 30th, 1916.)

13,028. "Electrodes for ionic tubes for use in wireless telegraphy, &c." O. Durdle & Osram-Robertson Lamp Works. September 11th.

13,029. "Rheostats." W. R. Sykes's Interlocking Signal Co. & R. W. Tarrant. September 11th.

13,057. "Overhead trolleys or collectors for electric tramway or railway vehicles." E. Spencer. September 12th.

13,066. Electric Incandescent Lamps. A. C. Woodman. September 12th.

13,070. "Magneto-electric ignition apparatus for internal-combustion engines." C. E. Hulse & M.L. Magneto Syndicate. September 12th.

13,071. "Magnetic compasses." E. C. Weilbach. September 12th.

13,073. "Wireless telegraphy and telephony." Western Electric Co. September 12th.

13,083. "Apparatus for driving magnetos for internal-combustion engines." Soc. Lorraine des Anciens Etablissements de Dietrich et Cie de Luneville. September 12th. (France, January 29th.)

13,084. "Apparatus for driving magnetos for internal-combustion engines." Soc. Lorraine des Anciens Etablissements de Dietrich et Cie de Luneville. September 12th. (France, March 3rd.)

13,094. "Audion or lamp relay for amplifying apparatus for use in wireless telegraphy and telephony." M. Latour. September 12th. (France, September 12th, 1916.)

13,098. "Devices for controlling intensity of electric currents." W. Adams & J. Watkinson. September 13th.

13,108. "Apparatus for heating water by electricity." J. H. Robinson and W. O. Workman. September 13th.

13,126. "Cable suspender." R. Hammerton. September 13th.

13,136. "Brush gear for electric dynamos and motors." T. L. R. Cooper, A. A. Lyon & J. C. Todman. September 13th.

13,139. "Brush and terminal contact mechanism of dynamo-electric machines." A. H. Darker & J. Stone & Co. September 13th.

13,141. "Incandescent electric lamps." J. Bilsfield. September 13th.

13,148. "Sparking plugs for internal-combustion engines." G. Rehder. September 13th.

13,164. "Electric switches, &c." W. H. Edwards. September 14th.

13,166. "Automatic electric switching apparatus." M. S. Conner & C. C. Puckette. September 14th.

13,167. "Telephone receivers." M. S. Conner. September 14th.

13,173. "Electrodes for electric furnaces." H. A. Blackwell, W. B. Hamilton & W. L. Turner. September 14th.

13,191. "Automatic telephone system." A. E. Stevens. September 14th.

13,192. "Automatic telephone sub-station mechanism." A. E. Stevens. September 14th.

13,193. "Automatic telephone central-station apparatus." A. E. Stevens. September 14th.

13,196. "Apparatus for detecting variation in a magnetic field." D. K. Morris, Morris & Lister and J. W. Rosbuck. September 14th.

13,221. "Electric ovens." K. Mjelva. September 14th.

13,225. "Apparatus for reception and utilisation of electric-current impulses for wireless, &c., telegraphy and telephony." W. J. Lyons & Selective Signal Co. September 14th.

13,260. "Electric signalling systems for mines, &c." Automatic Telephone Manufacturing Co. & C. Remington. September 15th.

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

7,064. Electrically-controlled Clutches. W. Langdon-Davies, A. Soames and Naamlooze Vennootschap de Nederlandsche Thermo Telephoon Maatschappij. May 17th, 1916. (108,871.)

11,906. Hand Lamps for Signalling. G. Burney & H. P. Lake. August 24th, 1916. (108,891.)

12,019. Primary Electric Cells. J. H. Nicholson (G. N. Antonoff). August 24th, 1916. (108,892.)

12,070. Mouthpiece for Telephone Transmitters. O. Thokie. August 25th, 1915. (101,206.)

12,147. Electric Furnaces. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 28th, 1916. (108,903.)

12,305. Means for Operating Apparatus at a Receiving Station from a Sending Station by Means of Electric Pulsations. September 7th, 1915. (101,411.)

14,290. Spears for Current-testing Apparatus for Electrical Appliances. C. E. Hunter & W. J. Davis. October 7th, 1916. (108,940.)

14,900. Electric Selectors. S. Ouilanine. October 20th, 1916. (108,949.)

15,290. Electric Current Rectifiers. H. Wade (H. S. Mills). October 26th, 1916. (108,954.)

15,680. Locking Device for use with Magneto-electric Machines. H. Knox, G. Weston & G. W. Barnes. November 2nd, 1916. (108,961.)

15,901. "Magneto-electric machines." G. F. Cooke. November 7th, 1916. (108,967.)

16,106. Dash-pot Retarding and Time-limit Devices, particularly applicable for use in conjunction with Electric Apparatus. Electric Control, Ltd., and O. Ellefsen. November 10th, 1916. (108,974.)

17,350. Treatment of Hydro-carbons for the Production of other Hydro-carbons of Different Specific Gravity and Boiling Point. L. B. Cherry. February 21st, 1916. (104,330.)

18,562. Automatic Cut-outs for Electric Circuits. R. Johansson. December 28th, 1916. (108,998.)

1917.

640. Overload Circuit Breakers. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.). January 15th, 1917. (109,003.)

1,125. Lamps. C. K. Maltby. January 23rd, 1917. (108,810.)

2,617. Protective Devices for Alternating-current Electric Systems. A. E. McColl. July 20th, 1916. (Divided application on 10,927/16.) (109,809.)

3,872. Regenerative Braking Systems. W. V. Turner. March 31st, 1916. (105,225.)

3,046. Drawn Filaments for Electric Incandescence Lamps. P. F. Guardiola. March 1st, 1917. (108,817.)

3,861. Appliances for the Shaping of Telegraph and like Insulators. Taylor, Tunnicliffe & Co. and P. Cooper. (March 16th, 1917. (108,821.)

4,336. Electric Motor Control Systems. British Westinghouse Electric and Manufacturing Co. (Westinghouse Electric & Manufacturing Co., U.S.A.). April 20th, 1917. (108,824.)

5,168. Systems of Control for Single-phase Commutator Motors. British Westinghouse Electric & Manufacturing Co. April 12th, 1916. (105,913.)

5,393. Insulation of Submarine Telephone Cables. Felten & Guilleaume Carlswerk Akt. Ges. April 14th, 1916. (105,573.)

5,315. Sparking Plugs for Internal-combustion Engines. A. G. France. April 16th, 1917. (109,619.)

6,036. Electric Multiple Switches. E. A. Laidlaw. April 28th, 1917. (109,023.)

7,712. Overwinding Preventing Switch for Electric Cranes or the like. S. H. Heywood and S. H. Heywood & Co. May 30th, 1917. (109,029.)

10,178. Dry Batteries. A. Armelin. July 13th, 1917. (108,846.)